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Differential Vulnerability to Debris Flow Hazard in Two High Mountain Communities of the Karakoram Himalaya, Northern Pakistan

by

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ABSTRACT

This thesis presents the findings of a comparative study of vulnerability, coping and risk-averting strategies and social responses to environmental hazards, particularly debris flow and flooding hazards, in the Northern Areas of Pakistan. Two small village-scale settlements, the prevailing form of community in the region, were selected as case studies and are described in detail. The villages exhibit a comparable subsistence agro-pastoral economy and socio-cultural organization reflecting similarities in environmental opportunities and constraints, historical processes and religious beliefs. However, they differ greatly in their proximity to commercial centres and in the rate at which modernization processes are being introduced and incorporated into the daily lives of villagers. Vulnerable groups are identified through a variety of methods including semi-structured interviews, empirical observations and participatory methods. All of these methods are grounded in the view that vulnerability to environmental hazards is tied to everyday activities and social inequalities in the study communities. At the household scale, socio-economic status is shown to be a contributing factor to differential vulnerability. Households with adequate access to resources and wide social networks generally fare better than those without these same resources and connections. Access to land, livestock and cash savings, coupled with kin and neighbourhood ties within and outside the community, generally ensure that these households are able to withstand losses from a damaging event. The introduction of modernizing influences often benefits those with sufficient resources and social ties, while simultaneously increasing the relative vulnerability of resource-poor households. Women and girls are identified as one of the most vulnerable groups—a condition that results from strong but variable gender divisions of social space, labour and influence within the study communities. This condition is generally heightened and extended by modernization processes that increase their workload and responsibility for the subsistence economy, yet do not increase their quality of life or standard of living. Meanwhile, the relative vulnerability of the Shia community, a community that fared well under the more traditional system, is increasing as a direct result of modernization processes that are inconsistent with religious beliefs regarding the strict seclusion of women. While the thesis shows women as a vulnerable group in various settings, it simultaneously emphasizes the differences in their experience within and between households, communities and villages. As a result, it illustrates the variability of vulnerability in a region often treated as a homogeneous unit by researchers and 'development' practitioners alike.

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CHAPTER I: INTRODUCTION

1.1 PROJECT INTRODUCTION

This thesis investigates vulnerability to environmental hazards and social responses to damaging events, as well as the known or potential effects of modernization processes on these. It looks primarily at how vulnerability is distributed within communities having strong but variable gender divisions of labour, social space and influence, and between communities having comparable livelihood systems but distinct local histories, religious traditions and socio-cultural characteristics.

The study is conducted among mountain societies of the Karakoram Himalaya in the Northern Areas of Pakistan. Two small village-scale settlements, situated in different sub-regions, are examined as case studies. The livelihood system in both villages is characterized by subsistence agro-pastoral and barter activities. However, interactions with commercial markets and opportunities for off-farm employment, particularly for men, have increased in recent years. There are indications that increasing interaction between local villages and regional, national and international centers is changing the distribution of vulnerability within local communities, particularly along gender lines.

A primary aim of the research is to situate risk and vulnerability within everyday life in the communities. This requires an understanding of local social and economic organization. Gender plays an important role in this organization due to patriarchal Islamic beliefs. As such, ways in which gender affects the distribution of risks and vulnerability within the study communities will be an important area of discussion for this thesis.

An integrative approach informed by ongoing conceptual and methodological debates within the vulnerability literature (Hewitt, 1983b), as well as in related disciplines, is employed in this thesis. The approach is largely geographical and draws upon well-developed sub-disciplines including human ecology (White, 1964; Hewitt and Burton, 1971; Burton and Hewitt, 1974; White, 1974), political ecology/economy (Sen, 1981; Watts and Bohle, 1993) and gendered perspectives (Enarson and Morrow, 1998). The approach also draws from debates in cognate disciplines including mountain, development and feminist studies.

An explicit attempt is made to be inclusive of those voices commonly left out of past research. This includes those lacking power, protection and decision-making ability and those separated from researchers and development workers by status, culture and language; this applies mostly to women in the present research context.

1.2 Contribution to Research

The aims and approach of this thesis contribute to several conceptual gaps in present knowledge. To date, many studies in the region have produced general overviews pertaining to environmental hazards or 'problems' and modernization processes. The results are often universally applied across the region. Relatively few studies have attempted to address some of the actual religious and cultural variability evident in local communities. This study addresses this research need by choosing a scale of analysis commonly neglected in past research.

The lack of comparative assessments completed in the region is also addressed by this thesis. Those studies that have focused on village-scale communities often have few

studies with which to compare their findings. Those that are available usually differ to some degree in the scope, focus or specialization. The research design employed in this study reduces the need to find studies of a similar nature. Furthermore, the juxtaposition of two case studies with similar scope and focus, allow underlying issues related to vulnerability to become more visible.

Previous research in the region has tended to be sporadic and specialized (with the exception of the International Karakoram Project and the Pakistan-German 'Culture Area Karakorum' Project). While perhaps not addressing the former problem, this study does address the later by employing an integrated approach that looks at both the environmental context of hazard events as well as the socio-cultural vulnerability of local communities.

The study's explicit focus on gender differences in relatively remote rural communities also contributes to research needs in the region. Studies of gender in Pakistan have predominantly focused on the predicaments of women in lowland centres. Little is written regarding the women of the Northern Areas, particularly beyond the major centres of Gilgit and Skardu. This thesis adds to this small volume of work and is particularly useful for its emphasis on how environmental hazards and modernization processes affect local women.

1.3 Purpose and Objectives

The purpose of this study is to describe debris flow hazard and vulnerability (both from a physical and socio-cultural perspective) in dynamic high mountain communities, with particular emphasis on differential and changing vulnerabilities. To fulfill this

purpose, I have defined five objectives: (i) to describe the physical nature of the debris flow hazard; (ii) to describe the distinct social, cultural, economic and political characteristics of the communities that contribute to their vulnerability; (iii) to describe the impacts of the marked gender division of labour, space and influence on vulnerability to debris flow hazard; (iv) to investigate changing vulnerabilities to debris flow hazard as a result of modernization processes or 'development'; and (v) to assess coping strategies and social response to debris flow hazard in the context of objectives (iii) and (iv) above.

1.4 Organization of the Thesis

This thesis is divided into eight chapters. Chapter II presents an overview of hazards and vulnerability literature. It begins by reviewing the hazards literature or the 'dominant' view that persists in the field today, despite continual criticism. I then discuss the conceptual and theoretical basis of the vulnerability perspective with its emphasis on the social construction of damaging events. The chapter mainly reviews the geographical literature but an attempt is made to include some well-known perspectives from cognate disciplines including sociology, anthropology and feminist critique. I conclude by describing the increasing call for integration that can be heard in the field of geography, not only in the particular sub-field we are interested in, vulnerability analysis, but also in resource management, development and mountain studies.

Chapter III presents an overview of the methodology employed in this study. It provides a rationale for the rather unconventional mix of quantitative and qualitative research methods including empirical observation, household surveys, local expert interviews and participatory observation and makes a case for the integration of

traditionally separated modes of inquiry. The methods employed in selecting the field site and interviewees are outlined and the process of interviewing and analyzing interview data are detailed. The chapter concludes with a detailed description of the many limitations experienced both within and outside the field.

Chapter IV briefly describes characteristics of debris flow processes and methods to identify them in the field. The importance of debris flow events, and mass movement processes in general, to intermontane sedimentation in the Karakoram is also discussed. The chapter concludes by describing some of the salient features of the Karakoram mountain environment to this study.

In Chapters V and VI, I present village case studies concerning vulnerability to environmental hazards in Northern Pakistan and, more specifically, in Nomal, District Gilgit and Haldi, District Ghanche, respectively. I begin by documenting the hazard history of the villages, concentrating primarily on debris flow and flooding events. I then discuss how socio-cultural organization within the communities affects vulnerability. Cultural adaptations and coping mechanisms evident within the villages are then addressed, indicating the adaptability and flexibility of local 'traditional' systems. Finally, I discuss how modernization is changing the conditions of everyday life and livelihood systems within communities, and thereby affecting the distribution of vulnerability and the coping strategies available to local community members.

Chapter VII provides a comparative assessment of the differences in vulnerability between the study communities and attempts to identify some of the underlying factors that produce vulnerable communities and individuals. An emphasis is placed on socio-economic position and gender as the primary factors influencing differential

vulnerability. I conclude the chapter with a discussion of how modernizing influences are affecting vulnerability within and between the study communities.

Chapter VIII summarizes the thesis and states its main findings. The chapter concludes with recommendations for future research in the study communities and the region.

CHAPTER II: SITUATING DIFFERENTIAL VULNERABILITY IN THE LITERATURE

2.1 INTRODUCTION

In the discipline of geography, as well as in the disciplines of anthropology, sociology and feminist discourse, the scope of concern and knowledge of differential vulnerability has broadened in recent decades. There has been a growing interest in how social, cultural, economic, and political conditions generate vulnerability and how individuals and groups perceive, cope with and respond to natural, as well as social and technological hazards. It has been shown that the effects of disaster are unevenly distributed between people, social groups, communities, regions, and within and between nations, and that vulnerable people and groups are likely to suffer a disproportionate share of the effects of disaster (Hewitt, 1983b; Blaikie *et al.*, 1994; Hewitt, 1997a; Enarson and Morrow, 1998). Furthermore, it has been shown that vulnerability is more closely related to everyday conditions of life and livelihood, rather than to some discrete, external, unknowable geophysical event (Wisner and Luce, 1993; Hewitt, 1997a). Despite these findings and an accompanying alternative movement, the hazards perspective, with its characteristic objective, technocratic approach to risk and disaster (Hewitt, 1983b), has been, and for the most part remains, the dominant mode of study of hazards, especially in the case of natural hazards and in the discipline of geography.

There is an identifiable separation between hazards and vulnerability research and literature. While there have been parallel activities in both fields of inquiry, little of it has attempted to combine understandings of the biophysical environment with understandings

of social, cultural, political and economic systems. The majority of the literature focuses too heavily on one or the other mode of explanation, with the physical environment or social-cultural system taken as a given depending on the specialty of the researcher. There has been a growing call within several cognate fields, namely hazards, resource management, development, mountain and gender studies, for greater integration and use of a wider spectrum of sources and modes of understanding when approaching complex research topics. An integrated approach has been advocated for mountain studies in the developing world as livelihoods are so closely linked to the natural environment. However, to date, the complexity of the developing world's mountain regions, including the Karakoram, has led mainly to detailed but separate study of both natural and socio-cultural phenomena at various scales.

In this chapter I review and critique the hazards perspective and its characteristic emphasis on the biophysical agent and means by which to control and manage it. I then introduce some of the important theoretical and conceptual underpinnings of the vulnerability perspective. I review several 'schools of thought' that contribute to present meanings and conceptualizations of vulnerability. The review especially draws from numerous studies in geography that have addressed vulnerability to environmental hazards and reflects an offshoot within the field towards viewing natural hazards as socially produced phenomena linked to everyday conditions of life and livelihood, rather than as isolated events caused by external agents (Gardner, 2003).

2.2 The Hazards Perspective

The most widespread approach to the study of hazards, risk and disaster has been alternately called 'vulnerability as pre-existing condition' (Cutter, 1996), the 'agent-specific approach' (Quarantelli, 1995) or the 'hazards perspective' (Hewitt, 1997a). This research framework is characterized by a focus on biophysical agents, the distribution of hazardous conditions, the human occupancy of hazardous zones (i.e., floodplains), and the degree of loss (life and property) associated with the occurrence of particular events (i.e., floods) (Cutter, 1996). The biophysical agent is described by reference to its magnitude, frequency, duration, areal extent, speed of onset, spatial dispersion and temporal spacing (See Table 2.1). Losses are described quantitatively as number of casualties, number of injuries and economic losses.

Table 2.1: Common measures of hazardous events significant in human terms (from Burton *et al.*, 1993).

Magnitude	Characteristic that defines the event; only occurrences exceeding some common level of magnitude are extreme.
Frequency	How often an event of a given magnitude may be expected to occur in the long-run average.
Duration	The length of time over which a hazard event persists.
Areal extent	The space covered by a hazard event.
Speed of onset	The length of time between the first appearance of an event and its peak.
Spatial dispersion	The pattern of distribution over the space in which it can occur.
Temporal spacing	The sequence of events (i.e., random, seasonal, cyclical).

Of all hazards studied, by far the most researched have been so-called natural hazards, although technological and social hazards have gained increasing attention over recent years (Cutter, 1993; Hewitt, 1994; Oliver-Smith, 1999). Within the natural hazards literature, which is most relevant for this thesis, there generally exists a straightforward acceptance that hazards result from 'extremes' in geophysical processes

(recent examples include Bryant 1991; Smith 1992; Alexander, 1993). Similarly, the geography of risk is usually related to the incidence of natural 'extremes' and the natural features directly associated with them, as well as with regions where natural 'extremes' occur or are more frequent and severe (Hewitt, 1997a).

A similar theme is present in the overwhelming majority of literature related to risk and disaster in mountain environments (Hewitt, 1992). Natural hazards such as floods, slope failures, snow avalanches, glacial-outburst floods, forest fires, earthquakes, volcanoes and other biophysical processes commonly impose costs on people and property in high mountain areas (Hewitt, 1992; Berkes and Gardner, 1997). Strong erosional forces act frequently or continuously, while others are released by anthropogenic influences (Hewitt, 1997b). The potential for disaster in mountain lands is presumed to increase solely as a result of the nature of the physical environment and 'extremes' in geophysical processes.

The result of this line of thinking is that the hazardous agent is viewed as external to the society rather than as an integral part of the continuum of human-environment relations. Disaster is seen as unavoidable or 'accidental' and solutions are aimed at controlling or managing the type, magnitude, frequency and other dimensions of geophysical processes (Hewitt, 1983b). Public policy aimed at dealing with and reducing the impacts of hazards have sought to control or modify geophysical agents through the application of control technology or through research and development to create such technology (Burton *et al.*, 1968; Hewitt, 1983b). The application of this technology has often resulted in adverse social and ecological consequences rather than alleviation of the problem it was designed to solve.

Also common to these studies is their little regard, or complete disregard, for the socio-cultural characteristics of individuals, groups and communities affected by hazardous agents and how these characteristics contribute to, or diminish the potential for disastrous outcomes. People are made to appear passive victims of natural events, or, at best, as acting out of ignorance (Hewitt, 1998a). While few researchers would deny that social, cultural, political and economic factors other than biophysical extremes affect risk, the sense of causality or the direction of explanation still runs from the physical environment to its social impacts (Hewitt, 1998a); social, cultural, political and economic factors are assigned a secondary position in most analyses, if they are included at all.

The pervasiveness of this approach and its ability to continue to dominate risk and disaster studies has resulted in it being termed the 'dominant' view by Hewitt (1983b). This thesis adopts a critical view of this approach, as is increasingly being done by geographers. This critique does not mean to imply that there is not value in understanding natural agents in and of themselves. On the contrary, understanding the natural environment and geophysical agents is essential to an understanding of risk and disaster, especially when such agents pose immediate risk to people. The difficulty is encountered when a hazards perspective is employed and a viewpoint is taken that classifies, explains and responds to disasters as if they were wholly or essentially a function of an external agent that impinges on a vulnerable society (Wisner and Luce, 1993).

Several researchers have become dissatisfied with this view as patterns of damage and loss are poorly explained by the nature of biophysical agents. Damage and loss vary widely between regions experiencing similar events, as well as between households and

household members experiencing the same event, more closely reflecting pre-existing social conditions, political structures and vulnerabilities. A natural event is not dangerous in and of itself but becomes so in relation to human activities and values. In fact, some events become hazards because of efforts by certain individuals or groups to exploit them as such and, as a result, to solidify their power and serve their interests. These observations have led some researchers to search for other ways of examining hazard events; to adopt an approach that views hazards as an integral part of larger on-going systems rather than as separate, discrete phenomena.

2.3 An Alternative Approach: The Vulnerability Perspective

An emerging theme has met with increasing acceptance amongst some disaster researchers in light of the above observations and has triggered an interest in the differential vulnerability of individuals and groups. The relatively new emergence of vulnerability analysis and its quick adoption by researchers in several fields dissatisfied with the hazards perspective has resulted in vulnerability being variously defined and conceptualized in the literature. In part, these discrepancies arise from the varying epistemological orientations of researchers and practitioners and the methodologies they employ, as well as from the considerable variation in hazards and the regions and locales (and scale of study) chosen for examination (Cutter, 1996). Despite more than two decades worth of collective research experience on the concept, vulnerability still means different things to different people (see Cutter, 1996 for an overview of the various definitions).

There is general agreement, however, that vulnerability, in its most basic form, implies proneness or susceptibility to damage or loss. This meaning is derived from the experience that some individuals and groups in society are more prone than others to damage, loss and suffering (Blaikie *et al.*, 1994). The experience of vulnerability is usually also closely correlated with socio-economic position and with key social characteristics including class, caste, ethnicity, gender, health status and age. Most definitions attempt to show the integrated way in which everyday social, cultural, political and economic conditions generate vulnerable people and places. This is an important departure from the hazards perspective as disasters can be interpreted as "the extreme situation....implicit in the everyday condition of the population" (Baird *et al.* as quoted in Wisner and Luce, 1993). Disaster is seen as an integral part of everyday or ordinary life.

For my analysis of differential vulnerability to debris flow hazard, I draw upon several theoretical approaches to, and models of, vulnerability. These include approaches from the fields of human ecology, political ecology/political economy and gender studies, as well as specific models such as 'the hazards of place' and 'the space of vulnerability'. The next section briefly introduces these approaches and models and discusses their differing conceptualizations of vulnerability. While none of these approaches are mutually exclusive or exhaustive, their separate discussion helps to distinguish between the theoretical and methodological directions of current research. Each sub-heading will be followed by a definition of vulnerability that highlights the factors considered relevant in each approach. The chapter concludes with a discussion concerning the relevance and contribution of the approaches both to my understanding of how individuals, groups, spaces and places become vulnerable and to the approach taken in this thesis.

2.3.1 Human Ecological Approaches

Hazard studies belong firmly in the behavioural field of human ecology, since by analyzing societal response to environmental stress one should be able to learn how different societies understand and adjust to the forces that help condition their existence. (O'Riordan, 1986)

A human ecological perspective, in the most general sense, refers to the relations between nature and society. There is a long-standing view within ecological studies that environmental benefits and constraints arise not solely from the environment but, rather, from the interaction of organisms with their environment (Morren, Jr., 1983). This interaction produces both positive results, termed resources and resource commodities, and negative results, termed hazards and damage (See Figure 2.1).

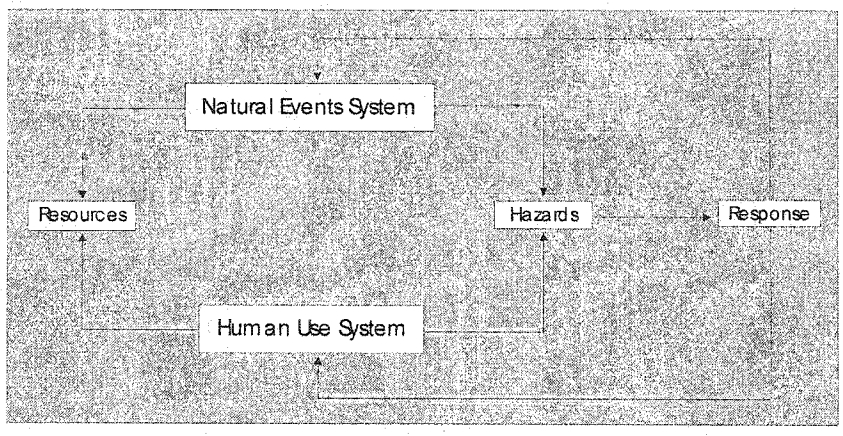


Figure 2.1: The interaction of the natural events system and the human use system produce both resources and hazards for human beings. In response to these hazards, society may modify the natural events system or the human use system (from Burton *et al.*, 1978).

Hazards are sometimes described as 'negative resources', thereby displaying the integrated nature of resource and hazards studies. This conceptualization is particularly suitable for many hydrologic, atmospheric and geomorphic processes as they are often resources in the manageable range and become hazardous only in the extreme range

(Burton and Hewitt, 1974). Thus, human ecologists view natural hazards as an important and significant component of the continuum of human-nature transactions and as a function of both the natural environment and the state of human society. Therefore, hazard and disaster potential relates as strongly to the normal activities of a society or community as to the particular nature of the extreme event.

Human ecologists are particularly interested in the range of adjustments available to or perceived to be available to individuals, groups and communities coping with environmental hazards and the process by which adjustments are chosen and implemented. Selection of adjustments is seen to depend on how the decision-maker(s) perceives both the hazard and the available adjustments (White, 1964). Human ecologists are less concerned with the situation immediately following a hazardous event than they are with the alternatives available for reducing damage from future occurrences. Thus, they are interested in the general state of preparedness of individuals, groups and communities to natural hazards. In this approach, people are viewed as adaptable, flexible and resilient actors who prepare for and respond to hazardous conditions. This is a significant departure from the hazards perspective where people are usually portrayed as ignorant victims of an unknowable hazardous agent.

There is a large volume of work from the late 1960s and 1970s that employs a human ecological perspective in its understanding of hazardous events and/or places (Burton *et al.*, 1968; Hewitt and Burton, 1971; Burton and Hewitt, 1974; White 1974; Burton *et al.*, 1978). This work was inspired by the pioneering work of Barrows (1923) and his interest in "the interactional adaptation of man to his environment" (O'Riordan, 1986, p. 276). Present research extends from the notions of Gilbert White and his

colleagues at the University of Chicago and their research concerning floodplain adjustments and coastal flooding in the United States. This work is generally credited as the first to investigate why certain adjustments to the risk of environmental extremes are preferred over others. A later work, inspired by White's conceptualization of natural hazards, uses case studies to explore the range of adjustments available to and implemented by communities in developed and developing world contexts in response to natural hazards (White, 1974).

More recently Burton *et al.* (1978; 2nd edition, 1993), in their book titled *The Environment as Hazard*, further develop these ideas by examining the role of individual and collective choice in selecting and implementing adjustments to natural hazards. They develop a theory based on their observations in eighteen countries. This theory contends that, in using physical resources, people engage in behaviour that combines adaptation to extreme events with both purposeful adjustments (i.e., change in location or resource use, actions to reduce loss, or the redistribution of loss) and incidental adjustments (those adjustments that reduce loss but are not employed for this purpose). In their view, the mix of adaptations and adjustments adopted is influenced by a variety of factors, the most important being event characteristics, human experience, resource use and material wealth.

In a later review, Mileti (1980) argues that 'social units' decide whether or not to implement adjustments to environmental risks based on several factors pertaining to their perception of risk of the hazard event and their perception of the cost and benefit of adjustment, both economically and socially. More specifically, he argues that three factors may be identified as playing critical roles in determining whether or not 'social

units' adopt adjustments to environmental extremes. These are: (1) the 'social units'' perception of the risk based on their ability to estimate risk, their past experience with damaging events, what they perceive to be the causes of environmental extremes and their propensity to deny risk, all of which are based on imperfect knowledge and biases; (2) the characteristics of the 'social unit' considering a risk-mitigating policy such as their social structure, resources and perception of the cost and/or benefit of implementing such a policy; and (3) inter-system incentives (i.e., the effect of macro-level policy initiatives or the wider social system on micro-level adjustment or individual and group response).

2.3.2 The 'Hazards of Place Model' of Vulnerability

In response to traditional conceptualizations of vulnerability as either pre-existing condition or potential exposure to risk (biophysical hazard), or as a social condition predisposing some response to an environmental risk (social vulnerability), Cutter (1996) proposes the incorporation of both biophysical and social understandings of vulnerability as they affect places in her 'hazards of place model' (See Figure 2.2A). The model grew out of the author's need to clarify what she saw as confusing and contradictory conceptualizations of, and approaches to, vulnerability. By reaching a more common and consistent conceptualization of the term, theoretical and practical understanding of how and why places and people are vulnerable to environmental hazards could be advanced. To achieve this end, Cutter returned to the earlier work of Hewitt and Burton concerning the hazardousness of places (1971) and, incorporating inputs from more recent literature, she produced "a useful heuristic in understanding the diverse elements that contribute to our understanding of the vulnerability of places" (1996, p. 535).

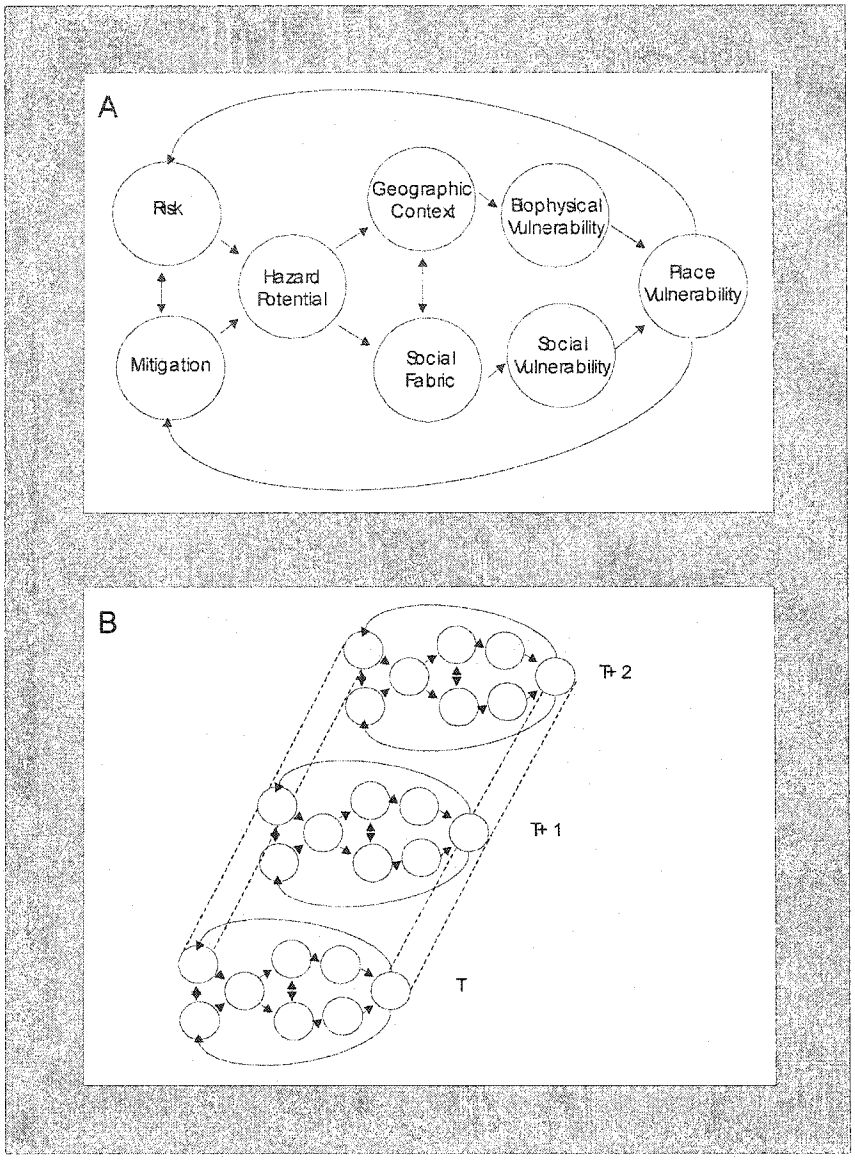


Figure 2.2: "The Hazards of Place Model". The various elements that constitute vulnerability interact to produce the vulnerability of specific places and the people who live there (A). This vulnerability can change over time (B) based on changes in the risk, mitigation and contexts within which environmental hazards occur (from Cutter, 1996).

The model depicts hazard potential as being a function of both risk, defined as "the likelihood of occurrence (or probability) of the hazard" (p.536), and mitigation, which refers to efforts to reduce risk. The employment of sound or appropriate mitigation measures may reduce the overall hazard potential while the employment of unsound or inappropriate mitigation measures may amplify the overall hazard potential. The hazard

potential is filtered through the social fabric of society to determine the overall social vulnerability of the place. Important factors to consider are socioeconomic status, cognition of risk and individual and/or societal ability to respond to risk. The hazard potential is also filtered through its geographic context (meaning its site and situation and proximity to the hazard) to determine biophysical vulnerability. The vulnerability of a place is generated by the intersection and interaction of both the social vulnerability and biophysical vulnerability. Two feedback loops allow changes in place vulnerability to be incorporated into the model through their influence on risk and mitigation. This, in turn, influences all aspects contributing to place vulnerability.

Absent from most other models of vulnerability is the context; that is, the place and time of the event. Cutter provides a model with an explicit focus on spatial and temporal aspects as critical factors affecting our understanding of vulnerability, risk and response. The emphasis on locality and the uniqueness of place makes the model particularly useful for geographers, as it is place that forms their fundamental unit of analysis. This place may be a geographic locale or region in which inhabitants are particularly vulnerable to one or several biophysical hazards or a social space defined somewhat arbitrarily by the social norms and structures of a given community. An added emphasis is placed on the ability of all the identified parameters to change over time, thereby affecting place vulnerability (See Figure 2.2B).

The prime advantage and simultaneously disadvantage of the model is its simplicity. The model may be applied to a variety of hazards by researchers and practitioners using a variety of methodological approaches. It may be applied in varying locales and at various times. While the author states that each of the major indicators

consists of a series of nested or contextual arrangements that influence it, these are not expanded on in the review. Thus, the terms used are largely left to interpretation and could lead to different interpretations and uses by different scholars, thereby contributing to the confusion of meanings and conceptualizations the author was trying to diminish.

2.3.3 Perspectives from Political Economy

> ....the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood is put at risk by a discrete and identifiable event in nature or in society. (Blaikie *et al.*, 1994, p. 9)

The most well-known, albeit contested, political economic approach to disaster within the field of hazards geography comes from the work of Blaikie *et al.* (1994) (also see Cannon, 1994). The authors distinguish themselves from earlier work within the political ecology/ political economy fields that they feel concentrated too heavily on class relations as the prime determinant of vulnerability. Instead, they recognize the role of a wide range of social relations in generating vulnerability. The approach advocated by the authors perceives disaster within the broader patterns of society and, therefore, does not segregate disaster from everyday living; risks involved in disasters must be connected with the vulnerability created for many people through their normal existence (Blaikie et al., 1994).

The basic premise of the approach is that some groups in society are more prone than others to damage, loss and suffering in the context of differing hazards. Social, economic and political processes that influence how hazards affect people in varying ways and with differing intensities generate people's vulnerability. This includes less tangible political and economic factors including the manner in which assets and income

are distributed between different social groups and various forms of discrimination that occur in the allocation of welfare (including relief). Vulnerability is thus a complex characteristic produced by a combination of factors derived especially, but not entirely, from class, gender, age and ethnicity and linked to wider interests of the state, national and international political economy (Blaikie *et al.*, 1994).

The focus of their approach on vulnerable people leads them to give secondary consideration to natural events as determinants of disasters. As Cannon (1994) states: "a disaster is the impact of a natural hazard upon vulnerable people and can be explained only by reference to both of these elements", such that "the disaster is really predetermined and the actual hazard event should be seen as the trigger mechanism" (p.22). In this sense, disasters are not seen as natural events at all but, rather, result from the political, economic and social construction of risk. It is the condition of the people that makes it possible for a hazard to become a disaster. Thus, explanation of disaster is only possible by understanding the ways in which social systems themselves generate unequal exposure to risk by making some individuals, groups of people, and societies more prone to hazards than others.

The authors develop their approach through the use of two models. The basis of the first model, the Pressure and Release (PAR) model (Figure 2.3), is that a disaster is the complex combination of those processes generating vulnerability on the one hand and physical exposure to a hazard on the other. In this overly simple model, the authors describe the way in which 'underlying factors' and root causes embedded in everyday life give rise to 'dynamic pressures' affecting particular groups, leading to specifically 'unsafe conditions'. All of these factors, root causes, dynamic pressures and unsafe conditions

are subject to change. Being at risk of disaster is shown to be the chance that the characteristics of people generated by these political-economic conditions coincide in time and space with an extreme 'trigger event' or natural hazard to which they have been made vulnerable. Increasing 'pressure' on people may arise from changes in either their vulnerability and/or from the impact (and severity) of the hazard. On the contrary, changes in vulnerability can 'release' people from being at risk.

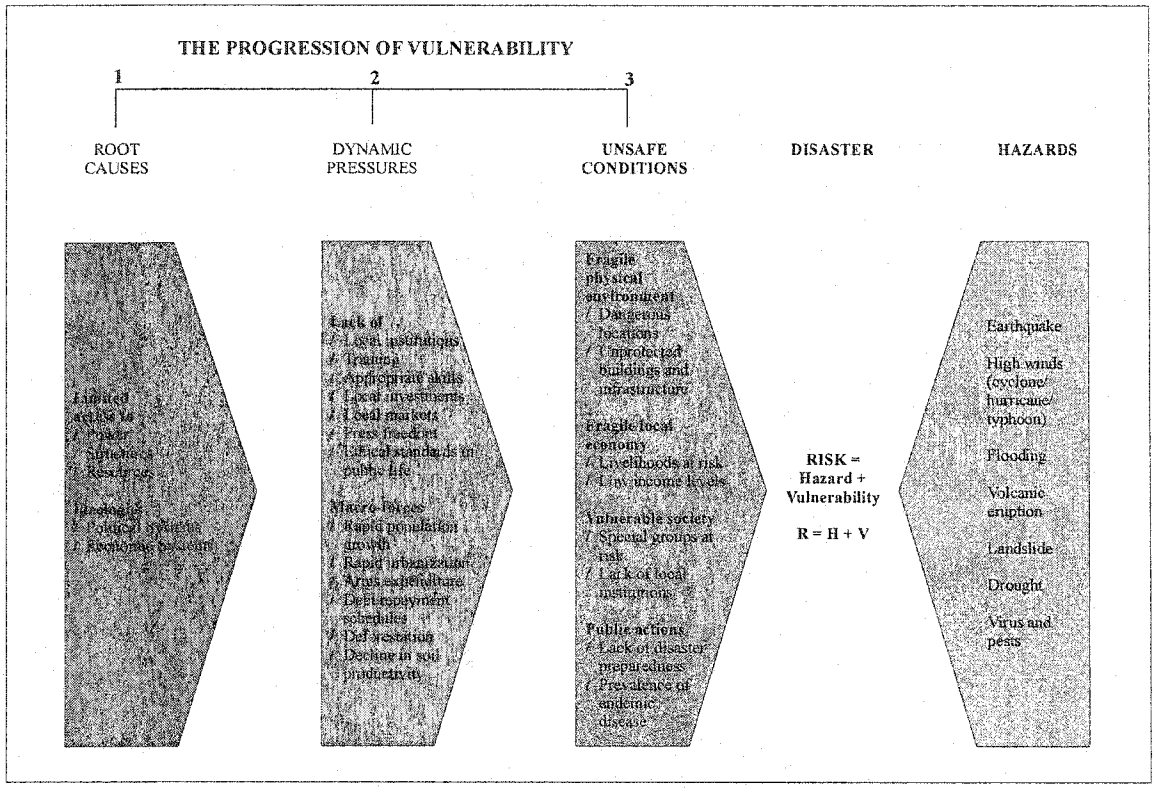


Figure 2.3: Disaster Pressure and Release Model depicting the progression of vulnerability and the 'pressures' that result in disasters (from Blaikie *et al.*, 1994).

A second model, referred to as the 'access' model (Figure 2.4), avoids the oversimplification of the PAR model which suggests (in its image of two separate sides in the diagram) that the hazard event is isolated and distinct from the conditions that create vulnerability. Several key concepts are introduced and defined in this model that are also key concepts for this thesis. A list of these definitions is found in Table 2.2.

Table 2.2 Definitions of key concepts presented in the 'access' model (from Blaikie *et al.*, 1994).	
Household (2a)	Economic decision-making units who share common eating arrangements which coincide with productive units
Access (2b)	Involves the ability of an individual, family, group, class or community to use resources which are directly required to secure a livelihood
Access profile (2b)	The collective access to resources that each individual or household possesses
Access qualifications (3b)	A set of resources and social attributes (i.e., skills, membership of a particular tribe or caste, gender, age) which is required in order to take up an income opportunity (box 3b)
Livelihood (6)	The command an individual, family, or other social group has over an income and/or bundles of resources that can be used or exchanged to satisfy its needs. This may involve information, cultural knowledge, social networks, legal rights, as well as tools, land and other physical resources

The model provides a more detailed and extended analysis of how vulnerability is generated by economic and political processes that allocate assets, income and other resources in a society and of how social systems create the conditions in which hazards have a differential impact on various societies, groups and individuals. More specifically, the model depicts how access to resources varies between households and household members and how these differences in access have a significant effect on potential loss, ability to deal with the impact of hazards to which they are exposed and rate of recovery. Those with greater combined access to resources and the social networks to mobilize resources from outside the household are less vulnerable to hazards and may be in a position to avoid disaster. The model indicates more specifically how conditions need to change to reduce vulnerability and thereby improve protection and capacity for recovery.

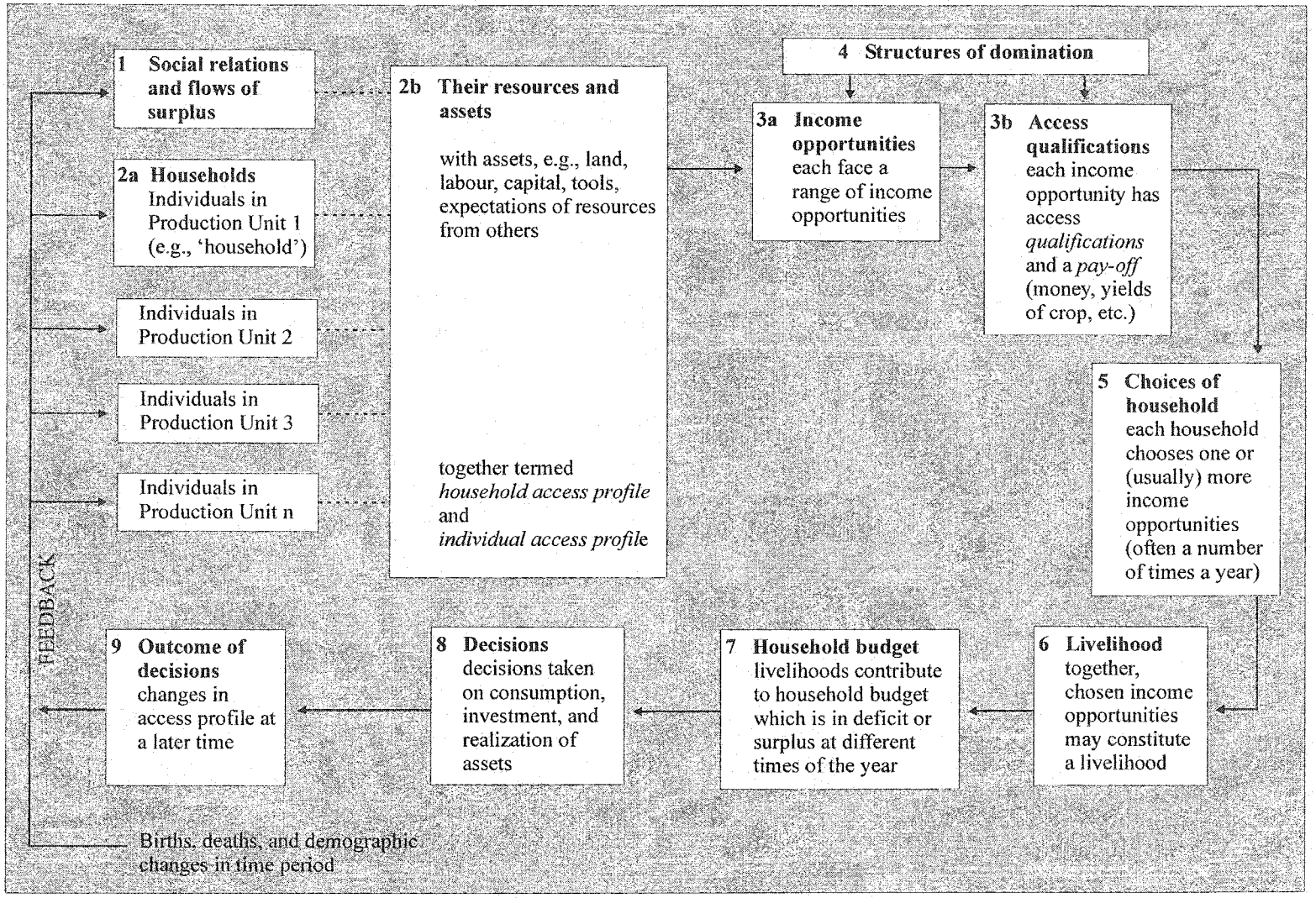


Figure 2.4: Access to resources model (from Blaikie *et al.*, 1994).

2.3.4 The Space of Vulnerability

> ...a multi-layered and multi-dimensional social space defined by the determinate political, economic and institutional capabilities of people in specific places at specific times. In this sense a theory of vulnerability should be capable of mapping the historically and socially specific realms of choice and constraint—the degrees of freedom as it were—which determine exposure, capacity and potentiality. (Watts and Bohle, 1993, p.118)

Present conceptualization of the social construction of vulnerability owes much debt to the work of several researchers interested in drought, hunger and famine (Sen, 1981; Watts, 1983; Wisner, 1988; Dreze and Sen, 1989; Dreze and Sen, 1990; Bohle *et al.*, 1993, Pyle and Gabbarm, 1993; Watts and Bohle, 1993; Wisner and Luce, 1993; Bohle *et al.*, 1994). These researchers and their works were among the first to examine the purely social construction of vulnerability for what was conventionally thought of as a chronic natural hazard. These researchers have shown how modern famines have not arisen from absolute food shortages within the food system (i.e., lack of food due to natural conditions such as drought) but, rather, result from lack of entitlements to, and command over, food as well as the disempowerment of vulnerable people (Watts and Bohle, 1993).

This perspective highlights the social construction of vulnerability as a condition rooted in historical, cultural, social and economic processes that impinge on the ability of an individual or society to cope with disasters and adequately respond to them. The nature of the hazardous event or condition is viewed as a social construct rather than a biophysical one. Thus, the causes of social vulnerability are explained by underlying social conditions that are often quite removed from the initiating hazard or disaster event.

Watts and Bohle (1993) define vulnerability by three distinct, yet related, processes that are theoretically derived and together constitute a causal structure of hunger and famine. The three causal powers are: (i) entitlement (command over food), (ii) empowerment (political/social power) and (iii) political economy (historical/structural class-based patterns of social reproduction). They suggest that the intersection of these tripartite processes produces the social 'space of vulnerability' (Figure 2.5). Through their model, it is possible to represent graphically both vulnerable groups and vulnerable regions.

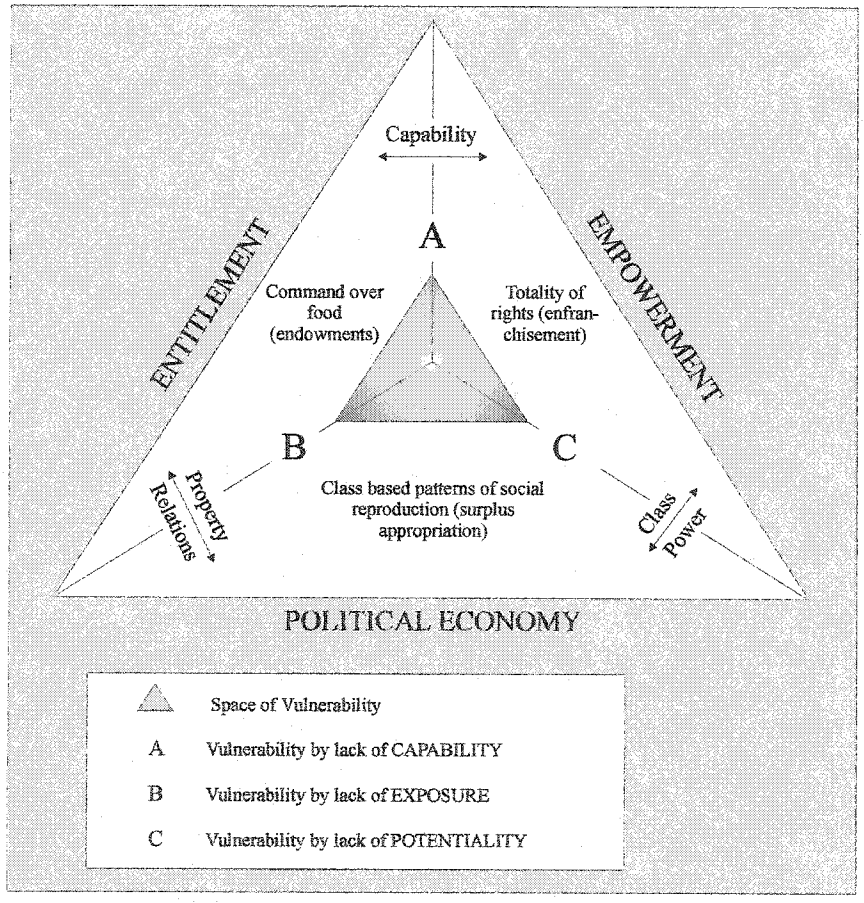


Figure 2.5: "The Space of Vulnerability" (from Watts and Bohle, 1993).

There are several noteworthy works that address the social construction of vulnerability to famine and drought. The work of Watts (1983) in Nigeria concerning

indigenous famine mitigating arrangements served to ground a critique of existing hazards and disaster work and a radical reformulation of the political economy of disaster. Wisner and Luce (1993) situated the problem of disaster within their extensive analyses of underdevelopment and marginalization in East African rural communities, emphasizing the vulnerability due to impoverishment of, and within, households.

The model has been applied to the problem of famine vulnerability in a comparative study of south Asia and sub-Saharan Africa and, in a subsequent analysis (Bohle *et al.*, 1994), to explain the social context of hunger and famine and vulnerability to climate change in Zimbabwe. A similar conceptualization is used by Dittrich (1998) in his examination of food (in)security in Northern Pakistan.

2.3.5 Gendered Perspectives

> Gender is a pervasive division affecting all societies and it channels access to social and economic resources away from women and towards men. Women are often denied the right to vote, the right to inherit land, and generally have less control over income-earning opportunities and cash within their own households. Normally their access to resources is inferior to that of men. Since our argument is that less access to resources, in the absence of other compensations to provide safe conditions, leads to increased vulnerability, we contend that in general women are more vulnerable to hazards. (Blaikie *et al.*, 1994, p. 48)

Certain characteristics of groups and individuals greatly affect their vulnerability to hazards. Some of these factors, such as socio-economic class, ethnicity and caste membership, have featured in vulnerability analyses since the 1970s. Others, especially gender and age, are more recent research topics and have developed in part due to the influence of social movements such as feminism. An increasing number of researchers are addressing gender issues in their studies of vulnerability, and are particularly

interested in the consequences of damaging events for women and children (Rivers, 1982; Cutter, 1995; Hapke, 2001).

As the perspectives discussed in this chapter have illustrated, the vulnerability of individuals and groups is not incidental in a disaster. Risk factors are deeply embedded in the conditions of everyday life. Conditions such as gender inequality produce gender differences in socioeconomic status, domestic responsibilities, power and access to and control over resources such as land and community organizations (Enarson and Morrow, 1998). Several researchers have shown that women generally have less access to resources (Shiva, 1989) and less representation in decision-making at all levels compared to men (Pietila and Vickers, 1990). In times of crisis, the already disadvantaged status of women is likely to be accentuated and become more visible.

The recent expansion of the global market economy to incorporate traditional societies has also had considerable consequences for women who are generally less involved in public affairs. Wiest (1998) discusses the relationship between domestic arrangements and women's vulnerability and coping capacity in times of disaster. Data from his work in Bangladesh, supplemented by examples from rural Mexico, illustrate how global capitalism in many parts of the world has reduced the capabilities of individuals and families to cope with crisis and how women typically bear the brunt of these economic changes.

Despite the obvious linkages between gender inequality and social vulnerability, gender has been largely ignored in mainstream disaster work, particularly in research and practice in the developed world. In a literature review concerning gender and disasters, Fothergill (1998) encounters a great deal of difficulty in finding research studies that

address the implications of gender in disaster in any meaningful way. Synthesizing over 100 disaster studies that have addressed gender issues to some degree (usually only minimally), she discusses the implications of gender, particularly as it affects women, in relation to nine stages of disaster. Throughout these stages, namely: exposure to risk, perception of risk, preparedness behaviour, warning communication and response, physical impacts, psychological impacts, emergency response, recovery and reconstruction, the pattern revealed by the review is one of inequality. Women's lower status and lack of economic power in everyday life have serious ramifications in the event of disaster where these conditions are often maintained and reproduced.

Researchers of disaster vulnerability in the developing world have tended to be more sensitive to gender dynamics. The developing world literature frequently considers the political economic forces that contribute to the production of differential vulnerability to disaster (Bolin *et al.*, 1998). It examines the significance of socio-cultural systems and how they variously privilege one gender over the other. The research is usually sensitive to the complex and heterogeneous nature of classes, cultures, ethnicities, and genders, and thus avoids sweeping generalizations that ignore diversity (Bolin *et al.*, 1998). However, it tends to discuss gender under the heading of class and culture. Women and gender are rarely analyzed directly in disaster research.

In light of these findings, several researchers have made suggestions about the course future research should take. Bolin *et al.* (1998) suggest that current research must move beyond oversimplified sex role explanations of vulnerability and adopt a perspective that examines how gender stratification and conflict affect disaster experience at all levels, from larger societal processes to the distribution of resources within families.

Fothergill (1998) suggests that future work in disaster research concerning gender needs to involve more in-depth, qualitative research in order to obtain a better understanding of women's lived experiences in disasters in the context of their specific situations.

2.4 Conclusion

This chapter introduces the various approaches to, and conceptualizations of, hazard, risk and disaster that characterize current research in hazards geography and vulnerability analysis. The first section introduces the 'dominant' approach employed by the majority of researchers and practitioners and its characteristic emphasis on the biophysical agent and methods by which to control and manage it. I criticise this approach for several reasons, the foremost among them being its inability to explain actual outcomes on the ground. The view of disaster as being wholly caused and explained by the nature of 'external' biophysical agents that act on a homogenous, ignorant human population does not fit well with actual findings in the field. The approach pays little attention to either the role of humans and socio-cultural systems in preparing for, averting, coping with and responding to disaster, or to the range of 'lived' experiences encountered at the individual, group and community scale.

Instead, I advocate vulnerability analysis as an alternative and more fitting approach for current hazard studies. I review several 'schools of thought' that have made significant contributions to the current meanings and conceptualizations of vulnerability to come to a common conceptualization useable for this thesis.

The first two sub-sections discuss vulnerability from a human ecological perspective. This approach views natural hazards as part of the continuum of human-

nature transactions and is largely concerned with how people perceive hazards and choose and implement adjustments. It is concerned with human agency, coping mechanisms and social response both prior to and following damaging events. Continuing from this conceptual standpoint, 'the hazards of place' model illustrates how risk perception and mitigation strategies combine to determine hazard potential, which in turn is mediated through the social fabric of society and biophysical environment to determine social and biophysical vulnerability respectively. The emphasis this model places on spatial and temporal concerns is particularly fitting for a geographical approach to disaster.

The next two sub-sections address political ecological and political economic approaches to disaster and their emphasis on understanding the mechanisms through which social, political and economic systems make specific groups in specific places more vulnerable to damage, loss and suffering than others. Vulnerability is shown to be a complex characteristic produced by a combination of factors derived especially, but not entirely, from class, gender, age and ethnicity and linked to wider interests of the state, national, and international political economy. Coming from a similar perspective, the 'space of vulnerability' model shows how vulnerability arises from the interaction and intersection of three related processes, namely: entitlement, empowerment and political economy.

I conclude by discussing a newly emerging concern in vulnerability analysis—gender. As this section illustrates, the voices of women and children are largely missing from past and present disaster research, despite the obvious ties between gender inequality and social vulnerability. Several researchers have shown that the everyday conditions of women's lives in some parts of the world make them particularly vulnerable

to hazards. It has further been shown that these everyday conditions are changing as a result of global market forces, often to the detriment of women.

Despite the varying foci and emphases of these approaches, it is clear that common ground exists and a common conceptualization of vulnerability is possible. I view this common conceptualization to be the following, and it will serve as the basis for this thesis. A vulnerability perspective emphasizes the predicaments and capacities of those at risk and the societal conditions that may expose individuals and groups to extreme events or constrain the range of adjustments, responses and protections available to them. It views disaster as a function of social, cultural, political and economic inequities in society existing prior to a hazardous event and 'triggered' by natural disturbances which are part of the continuum of human-nature interactions. The approach encourages direct and long-term observation of everyday conditions of society and environment and interaction with those most affected by extreme events. It analyzes interactions at and between various scales: individuals, groups, households, local communities, regions, nations and the wider global community. The next chapter discusses the implications of this conceptualization of vulnerability for producing a workable and ethical methodology.

Chapter III: Methodology, Methods and Data Sources

3.1 Introduction

Like other dimensions of social, cultural, economic and political life, the everyday conditions that influence vulnerability to damaging events in Northern Pakistan are difficult to observe, identify and quantify. There are few situations, if any, where one can assume that the circumstances of villagers' lives and livelihoods can be reduced to a neat set of quantifiable variables. As the preceding chapter illustrated, there are many possible approaches to vulnerability, yet no easy or straightforward way to measure it. The issues that lie at the core of this thesis present a challenge to data collection, analysis and representation. This situation is complicated by a lack of secondary sources that describe the meanings and experience of damaging events in Northern Pakistan.

Nonetheless, there is a vast body of literature to draw upon that parallels the critiques of the 'dominant' view within the vulnerability literature within their own fields of inquiry. The methodological approach employed in this thesis draws significantly from epistemology and methods used in cognate fields to gain insights into social systems and vulnerability. Much of the criticism and aims of these fields parallel the criticism and aims of this thesis. Specifically, the objective, positivistic approach to social issues with its overarching models and theories and overemphasis on 'Western scientific' or 'expert' knowledge and technical solutions is critiqued. An approach is advocated that sees knowledge as 'subjective' and that views indigenous knowledge systems as legitimate and valuable forms of knowledge, at least in crucial ways for our subject. This approach

lets people speak for themselves and is reflexive of the position of the researcher in relation to her/his research participants.

Firstly, I review the methodological approach used in this study and its foundation within various fields of inquiry. Secondly, I describe how the field sites were selected. These sites will be discussed subsequently as two separate case studies. Thirdly, I describe the methods and data sources used to come to an understanding of vulnerability in the community. I discuss how a combination of quantitative and qualitative research methods allowed the experience of damaging events in this particular place, at this particular time, to be situated. Finally, I discuss the methodological limitations I encountered during fieldwork.

3.2 The Methodological Approach

The challenges to collecting data about damaging events raise theoretical, practical and ethical questions concerning how best to explore this highly sensitive and complex topic. Many scholars have identified similar challenges regarding data and data collection and have raised practical issues about how best to approach field-based research (Dyck, 1993; Katz, 1994; Rocheleau, 1994, Rocheleau, 1995; Jones et al., 1997). In this section, I aim to contribute to these methodological debates through the example of my own research in Northern Pakistan. My methodology has been informed, at various stages, by research in the fields of hazards and vulnerability, resource management, critical social theory and feminism. First and foremost, my approach draws from geographical debates within the hazards, vulnerability and disaster literatures. Many of the important components of these debates were addressed in the first chapter,

particularly the criticism of 'dominant' scientific paradigms and positivistic approaches to research. This criticism will be further elaborated upon in this section, but from the stance of critical social theory and feminism. But first, I will address an emerging call for greater integration of social and ecological systems within resource management, mountain and development studies.

3.2.1 Lessons from Resource Management, Mountain, and Development Studies

The need to integrate ecological and socio-cultural systems and methods by which to do so has been an ongoing debate in the current literature. The majority of past and present research treats resources and hazards as discrete entities in isolation from the rest of the ecosystem and the social system. The implementation of management and mitigation 'solutions' based on this viewpoint has often times failed to alleviate problems. Many researchers agree that current approaches to understanding resources and hazards have been too focused on either the social system or the ecological system and that sound practices require a fundamentally different approach (Wilson and Morren, Jr., 1990; Berkes and Folke, 1998; Alcantara-Ayala, 2002).

There has been a growing call in the literature over the past two decades for integrated studies of resources and hazards; those which take into account both ecological and social systems (Berkes and Folke, 1998; Folke *et al.*, 1998; Jodha, 1998), integrate natural and social environmental science (Forsyth, 1998) and employ trans-science as opposed to cis-science (Thompson and Warburton, 1985). This approach is particularly advocated for the Himalayan mountain context where uncertainty is such a marked feature of the region due to its remarkable physical, ecological, social and cultural heterogeneity (Thompson and Warburton, 1985; Jodha, 1998).

In their book entitled *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*, Berkes and Folke (1998) explore the reasons why conventional prescriptions of resource management are in many cases not resulting in sustainability. They contend that either the social system or the ecological system tends to be taken as a 'given', depending on the research background of the researcher(s) when, in fact, social and ecological systems are linked and that delineation between the two is artificial and arbitrary. A fundamentally different approach to resource problems is advocated; one in which resources are not treated as discrete entities in isolation from the rest of the ecosystem and social system. This type of inquiry requires that a wider range of considerations and sources of information be mobilized than in conventional approaches. One such source is traditional ecological knowledge, or the cumulative body of knowledge and beliefs about the relationship of living beings with one another and with their environment handed down over generations through "cultural transmission" (Studley, 1998). There is potential to involve local ecological knowledge for the improvement of resource management in mountain ecosystems. Traditional systems in mountain areas represent many millennia of human experience with environmental management, and provide a reservoir of active adaptations that may be important for sustainability.

Thompson and Warbuton (1985) argue that cis-science (i.e., analysis in terms of physical facts and dealing in technical fixes) has been inappropriately conceived and employed in the Himalayan context. First and foremost, cis-science requires the identification of all the components of the Himalayan system and all the connections between those components involved in a given problem as well as the relative rates of all

the processes involved. The authors illustrate the challenges to quantification in a region where formal records are practically non-existent and where local peoples often respond to questions concerning resource use based on what is socially or politically acceptable or desirable or based on what they think the researcher wants to hear. Attempts at quantification such as single visit survey questionnaires have been shown to be unreliable (Thompson and Warburton, 1985). Such 'biases' pervade information relating to ecological and social mechanisms in these regions. In addition, data concerning the abundance of a given resource is equally hard to assemble. The use of cis-science in the region has led to a false sense of certainty regarding Himalayan environmental 'problems', as the authors illustrate through the example of Himalayan deforestation.

As an alternative, Thompson and Warburton (1985) suggest a trans-science approach to uncertainty. They contend that the Himalaya is a complex region that can never be entirely characterized or known and, as a result, the methods of trans-science are much more appropriate. They describe trans-science as "the science of messes" and accord a central place to the perceptions of the researcher. Herein lies the problem with the traditional role of the cis-scientist: the observer is inevitably a part of the system under observation. As the authors state, "our terms of reference and, indeed, the whole context within which the institutions we are embedded in were able to come together to conceive, approve, and fund this project predisposed us to grant credibility to one particular problem definition" (123). The authors further suggest that there is not *a* problem but, rather, "a plurality of contradictory and contending problems" (133) for which the classic Operations Research approach (i.e., progression through problem formulation, problem analysis and problem solution) cannot operate. Instead, the wide

uncertainty that pervades the Himalaya allows a wide range of problems and solutions to lie comfortably within it.

As part of a special edition of *Mountain Research and Development*, Forsyth (1998) argues for the integration of natural and social environmental science to avoid uncritically accepting environmental 'myths' such as Himalayan environmental degradation and desertification. The author contends that commonly held beliefs concerning environmental 'problems' are inaccurate as they are based on poorly defined and specialized research that ignores the variability in mountain areas. He criticizes positivistic approaches to environment for two main reasons: (1) "the inference of universal laws from selective data obviously produces explanations that ignore the vast complexity of reality" (110), and (2) "the creation of each of these universal laws follows a procedure that starts with a perceived need for data. Each scientific inquiry is socially constructed according to the political, economic, cultural needs of the time and the resulting scientific laws coming from these inquiries reflect these agendas" (110). Thus, positivistic research is socially constructed and subjective, yet it rarely addresses the effect these biases have on data collection, interpretation and the writing process. Moreover, positivist research seeks patterns in data or universal truths. As a result, it often fails to adequately represent the variability in mountain areas.

As alternatives to positivism, Forsyth (1998) advocates employing approaches such as Cultural Theory, the 'new' ecologies, and critical realism in environmental research. He argues that research into environmental problems in developing countries needs to address both social and natural aspects of environmental change at the same time. Avoiding integration risks reiterating 'dominating discourses' of degradation.

3.2.2 Lessons from Critical Social Theory and Feminist Theory

The critical stance on 'Western' science evident in the preceding section is also evident in critical social theory and feminism. One of the major challenges of feminist theory to mainstream science and social science has been a powerful critique of positivism and its underlying assumptions (England, 1994; Nast, 1994; Staeheli and Lawson, 1994). Specifically, the concept that the scientist or social scientist can seek and uncover "facts" and "the truth" in order to further knowledge of universal truths is questioned. In its most extreme form, positive science dictates that value-free objectivity can and should be attained, and that research must be completely replicable by others (Wolf, 1996). This view of science necessarily involves and encourages distance between the researcher and the researched and assumes that the researcher can objectively observe and interpret the life and meanings of his/her subjects.

Researchers employing this view often perceive communities according to what Porter (1986, p. 6) describes as the "western experience of contemporary life which separates everything from everything" (as quoted in Butz, 1991). This can be particularly problematic in the developing world context as this perception contrasts with the way anthropological and cultural-ecological case studies describe traditional kin-based societies. Porter describes a situation where individuals live "a life of wholeness and connectedness – people produce what they consume, live and deal with risk and hardship within a reinforcing system of mutual aid and have a common set of values, life chances and life expectations" (1986, p. 1 as quoted in Butz, 1991). Consequently, approaches to studying these communities must address this different perception or worldview and aim

to view social, cultural, economic, political and ecological systems as integrated and intimately connected.

The aims of and, methodology employed in, critical approaches sharply contrast with those of positivistic science. The approach employed by researchers attempts to incorporate differing worldviews and has been described by Nielsen (1990, p. 6) as "contextual, inclusive, experiential, involved, socially relevant,...complete but not necessarily replicable, [and] inclusive of emotions and events as experienced". As Harding (1987) notes, feminists redefine who can be knower and what can be known; challenge the notions of objectivity and validity testing; come to terms with the distinction between researchers and their research subjects and identify the distinct purpose of each scientific inquiry. A feminist methodology, therefore, builds on experience and accepts subjective experiences as valid forms of existence (Moss, 1993), recognizes the ethical implications of the possible exploitation of the 'researched' as 'objects' of knowledge (Cook and Fonow, 1990), acknowledges the impact of the researcher on the research process and takes time to reflect on that impact (Moss, 1993).

Particularly relevant from this literature is its attempt to delve deeper into questions of knowledge and ways to approach the acquisition and legitimation of knowledge. Knowledge is often equated with some professional or specialized set of data or ideas in positivistic science. What is needed is an increased acceptance of a wider range of information sources and knowledge systems as legitimate and valuable beyond those used in conventional research practice. Specifically, I am referring to indigenous knowledge systems including knowledge developed through daily interactions of resource users with their environment and culturally transmitted knowledge accumulated

over generations. There is consensus among researchers using various terms for indigenous knowledge that such knowledge: (i) is linked to a specific place, culture or society; (ii) is dynamic in nature; (iii) belongs to groups of people who live in close contact with natural systems; and (iv) contrasts with 'modern' or 'Western formal scientific' knowledge (Studley, 1998). Indigenous knowledge encompasses spiritual relationships, relationships with the natural environment, relationships between people and is reflected in language, social organization, values, and institutions (Studley, 1998).

The methodological approach to vulnerability adopted here, then, is focused on an integrated understanding of social, cultural, economic, political and ecological systems, viewing them not as separate 'boxes' in some grandiose model but, rather, as interconnected, mutually perpetuating and inseparable factors that constitute the everyday conditions of life and livelihood in the study communities. It is based fundamentally on what local people have to say about local conditions and circumstances and is driven by an explicit aim to include those voices generally excluded or silenced in objective approaches or general overviews. Particularly, this applies to women, children and the land- and resource-poor. Finally, the methodology seeks to engage critically and reflexively on the research process as a way of addressing the power relations manifested in the relations between the 'researcher' and the 'researched'. This will be discussed in greater detail in the "Dilemmas and Limitations" section below.

3.3 Selection of Study Sites

My interest in doing research in the Northern Areas of Pakistan stemmed from my broader interests in mountains, geomorphological hazards, resource management and

cross-cultural research. I carried out fieldwork in the villages of Nomal, District Gilgit in June and July 2000 and in Haldi, District Ghanche in June and July 2001. During my initial visit, I resided with a local family and gathered data on the recurring debris flow events the village experiences, as well as on the differing and changing circumstances of vulnerability, coping mechanisms and social responses to these damaging events. This initial visit enabled me to become familiar with the social and cultural context, including the religious beliefs of Islam and intra-household dynamics. As well, it allowed me to witness, first hand, the rapid rate at which transformation is occurring in mountain villages. This period of research provided the foundation for my second, more intensive, session of fieldwork in Haldi and allowed me to refine the theoretical and methodological approach of this thesis.

I was interested in selecting field sites where I could examine a range of processes and their role in creating vulnerable places. Ideally, these places would have a long history of exposure to natural hazards as well as a long history of human habitation and resource use. The longevity of these settlements despite repeated damaging events attest to their considerable resiliency. Many villages of the Northern Areas have been settled for centuries and have been exposed repeatedly to damaging events. From a wider perspective, the villages are sites of intimate contact between humans and their environment, in both positive terms (resources) and negative terms (hazards). Historically, and at present, livelihoods depend on an intimate knowledge of resources and hazards.

The villages of Nomal and Haldi are no exception. Both have a similar hazard history characterized by frequent flooding and debris flow events as well as a long history

of settlement. These locations were purposely chosen due to the recency of debris flow and flooding events. Both have experienced recurrences within the last five years which were particularly damaging for the village, but nothing particularly damaging within the last two years. These selection criteria ensured that residents had personal and recent experience coping with damaging events; however, not so recent as to be traumatizing. Both villages were small enough that a good understanding of debris flow hazard, social organization and activities could be achieved during the relatively short field seasons.

The most important factor in my decision to conduct research in these two villages was the familiarity of my advisors with these two specific field sites. Either one or both of them had spent significant amounts of time in these villages or with community members from these villages. Their connections aided my entry into the field. They had already developed relationships with villagers based on trust and mutual respect; my association with them facilitated my acceptance within the village and allowed my presence to be legitimized in the eyes of other community members.

Their connections also allowed me to contact potential research assistants to act as guides and translators in the field – a necessity for my research as I would need to be accompanied around the village and did not speak the local language(s). My research assistants spoke English and Urdu (the national language of Pakistan) as well as one or all of the local languages (Burusheski and Shina in Nomal; Balti in Haldi). Their ability to speak English allowed us to communicate, while their ability to speak Urdu and the local language(s) ensured that they could communicate with local peoples. Knowledge of local languages was particularly important as many women are not formally educated and do not speak the national language.

Identifying a suitable research assistant proved to be a difficult task for the second field season in Haldi as I planned to have mainly female research participants and would therefore require a female research assistant. In the more remote villages of Northern Pakistan, it is difficult to find women who can speak Urdu and/or English and who are allowed to work outside their homes. Luckily, a 16-year-old girl named Fatima* who grew up in Haldi and moved to Islamabad when she was six met this requirement. She had been returning to the village with her family to visit other family members nearly every summer since she moved. She was one of only two girls in the village who had completed her matriculation (the equivalent of Grade 10). Her status as both a resident outside the community (and downcountry) and a member of the community, coupled with her status as an educated person, meant that she was largely supported in her work outside the home as my research assistant.

My connection with well-respected community members was valuable for legitimizing my presence and facilitating my research (it was also limiting but this will be discussed in greater detail later). Through these associations, I was able to participate in the range of daily activities and festive occasions within the village, including working, performing domestic responsibilities, eating, singing or attending weddings and religious celebrations. Furthermore, my research assistants introduced me to other community members who subsequently allowed us into their homes, served us *chai* (milk tea) and spoke to us about their personal experiences. Without these associations, my research would not have been possible.

3.4 Methods and Data Sources

My approach to data collection necessarily relied on integrating quantitative and qualitative methods. These methods included empirical observation, household studies, specialized interviews, informal conversations and participant observation. The grouping of these methods and data sources allowed elements of vulnerability to be situated within wider livelihood and resource concerns, and facilitated communication between the research participants and myself. Living and working in the community helped me enter the range of sites used by villagers for work and domestic responsibilities; sites often misrepresented in "objective" empirical approaches (Oberhauser, 1997). This section of the chapter details the series of methods that were employed to gain insight into debris flow hazard and vulnerability in Nomal and Haldi.

3.4.1 Empirical Observation

Empirical observations in the field largely contributed to an understanding of the biophysical risk to the community. Field investigations led to the identification of potential or known hazards; their distribution and relative proximity to the community and its infrastructure; land use patterns with particular emphasis on the location of residences, staple and commercial crops; and activities as related to who and when villagers were at risk.

The debris flow hazard was examined using a variety of methods. A preliminary survey was conducted upon arrival in each of the villages. The survey allowed past and present sites of debris flow events to be identified. Initial surveys used a hand-held Garmont Global Positioning System to provide accurate positioning of debris flow tracks within the village. Data collection consisted of documenting past and former sites of

debris flow activity with photographs and video, noting characteristics of source area material, channel and run out zone, producing longitudinal and cross-sectional profiles and producing facies models and particle size distributions from exposed sections.

3.4.2 Household Studies

Household studies were an essential element of my research and contributed to an understanding of how different community members rate and respond to environmental risks (Baxter and Eyles, 1999). In all, 50 household studies were conducted at the two research sites (19 in Nomal and 31 in Haldi). The household studies were made up of two components. The first component involved a semi-structured interview with either the male head of the household (generally the case in Nomal) or with a female household member (generally the case in Haldi) (See Appendix A). In either case, other family members were usually present and sometimes assisted in answering questions. The second component involved observation within the household and later recording these observations in my journal. Both components were accomplished simultaneously.

Household studies served several purposes. Through my visits, I was able to situate the household within the larger neighbourhood and community as well as in relation to former sites of debris flow activity. In the event that a household had been exposed to a past event, I was able to discuss and document past damage to property and livelihood systems and to gauge the resiliency of the household and household members, through the coping strategies employed immediately following the disaster and in longer-term recovery. Studies also revealed the various responsibilities of family members involved in coping and recovery (i.e., who in the household was responsible for what in the event of disaster, immediately following disaster and in longer-term recovery and

preparedness for future events). Interviews provided a means by which to enter the usually closed household and gauge intra-household organization and inequities. I was able through questions and observations to collect information about patterns of access to resources and coping strategies as they are differentiated by gender, age, ethnicity and class. Through these face-to-face encounters, I was provided detailed information that is only available through dialogue with family members.

3.4.2.1 *Sampling*

Households were selected through purposeful sampling so that greater variation within the community was sampled and so that critical cases could be identified and examined. The use of 'snowballing' was also significant; that is, asking research participants to suggest other possible research participants who could give valuable insights into the research. Selection of a household was not solely dependent on prior experience with or exposure to debris flow events. Effort was made, however, to identify individuals more often than not with prior exposure so that coping mechanisms and degree of resiliency and recovery could be discussed.

Potential interviewees were often identified and first introduced to me by one of my field assistants while doing other work around the village. No individuals refused to participate outright, although some individuals failed to answer questions or had little to say once the interview began. These experiences will be elaborated upon in the "Dilemmas and Limitations" section below.

3.4.2.2 *Procedure*

I devised an interview template that included both structured and semi-structured questions to explore the linkages between vulnerability, perceptions, household resources

and coping strategies (see Appendix A). I focused on three particular themes, namely risk and response, modernizing influences and environmental change. The research participants were informed of the nature of my research and permission was granted before an interview was conducted. Each interview lasted approximately one hour. Following each interview, the research participant was asked whether they would have time to show us their lands and any sites of former damage within the village. If time allowed, this tour was conducted immediately following the interview. Otherwise, another time was arranged and we returned at this later date.

3.4.3 Local Expert Interviews

Several specialized interviews were carried out with local community members who could discuss specific issues relevant to each of the research communities. Interviews were conducted with representatives of local government, religious institutions, educational facilities, health care facilities and local non-governmental organizations working in the area. I was able to conduct most of these interviews in English; the others were conducted with the aid of a translator in either Urdu or the local language. The spontaneity of most of the interviews coupled with the diverse backgrounds and specializations of the discussants necessitated that the interviews be largely unstructured. What usually resulted was a lively discussion between these community members and myself allowing a range of topics and opinions to be touched upon. Interviews ranged from one to three hours.

The intention of these specialized interviews was to glean vital information about social and physical well-being, cultural knowledge and community values within the specific context of the study communities. The discussions provided information on the

history of the villages; traditional institutions responsible for law and order and the use of common lands; the differential conditions of health and education within the communities; religious beliefs of Islam and their role in local organization; local perceptions of 'external' entities such as national government and development agencies; and environmental, economic and social change in the villages. In all, specialized interviews provided insights into both the context and social relations shaping household and community vulnerability.

3.4.4 Participatory Observation

Participatory observation through in-community residence allowed for a greater understanding of the day-to-day activities of villagers and the everyday conditions of village life. Participant observation involved living with community members and being involved in the range of daily activities being performed in the village whether it be working in the fields, on irrigation channels or in kitchen gardens, performing domestic responsibilities or singing at nighttime on the *dachda* (a wooden platform used to take meals on or sleep on during hot summer months). A diary was kept which recorded daily events and conversations with villagers, discussions with research assistants and observations made while walking around the village, staying home or visiting other households.

My experience living in the two study communities differed, in part due to the conditions of my residence during my visits. In Nomal, I lived with a local family and was involved in most aspects of family life. I was able to observe intra-household dynamics and to identify the gendered and spatial division of activities and responsibilities among household members. The prominent division of labour in the

community was observed first-hand at the household level. In contrast, I lived in a rented home with my two research assistants while in Haldi. Fortunately, I developed close relationships with some of the community women whose husbands were away for employment either portering or working downcountry. In addition, my primary research assistant had many close-kin ties in the village. These close relationships resulted in frequent visits and many opportunities to observe intra-household structure and activities.

3.5 Dilemmas and Limitations in Fieldwork

At various stages throughout the research process, I was aware of the politics of fieldwork and the power relations between my research participants and myself. Despite this effort, I encountered several methodological dilemmas during and after my fieldwork. These dilemmas shaped the information I was able or not able to gather and therefore contribute to the 'partial truth' that this thesis necessarily represents (Wolf, 1996). This section of the chapter details my dilemmas in the field and is largely informed by the work of feminist researchers and their struggles during and after fieldwork (Wolf, 1996). The dilemmas discussed, although usually specifically applied to the experiences of feminist researchers, are more widely applicable. Researchers concerned with the power differentials inherent in cross-cultural research and issues of writing and representing the 'other' will relate to these dilemmas. The underlying issue is power and the often contradictory, difficult and irreconcilable positions the researcher faces while attempting to conduct ethical, empathetic research (Wolf, 1996).

3.5.1 Issues of Gender and Mobility

As I discussed earlier, my presence in the study communities was legitimized through my association with my advisors and, through them, with community members. However, several conscious decisions I made before entering the field site facilitated my acceptance. I made these decisions out of respect for local beliefs, traditions and customs, but also to gain the trust and respect of community members – a necessity for my research. During my stay in the two villages, I decided to conform to local gender norms. These norms included wearing *shalwar kamiz* (the local dress consisting of long, baggy pants and shirt) and a *dupatta* or *chadar* (veil) as well as adhering to the restrictions placed on women's mobility. I never left my household compound without the accompaniment of a guide and hardly ever without a male guide (except in acceptable situations in Ismaili communities where groups of women may walk together).

These decisions raise questions about the differences in power between the researcher and the researched. My position as an unknown guest in the community allowed me to (mis)represent myself as I wished to gain entry into the lives and homes of community members, despite the fact that I was trying to build trusting relationships with them. My study participants did not have this same power as they were surrounded by their kin and friends and could not similarly alter aspects of their identity.

The way in which community members perceived me also affected the research process. Initially, my status as a guest in the community afforded me the hospitality of most residents. My impromptu interviews were generally met with excitement and a sense of occasion. *Chai*, biscuits and local fruits were quickly brought out to feast upon and a pillow was placed behind my back. In time, I was able to overcome this status to

some extent by meeting people in the sites of their daily activities and through repeated visits to their homes.

Later on in the season, my status in the field was varying and complex. As a white, foreign woman, I had secondary status because of gender but acquired privilege through class, race and my association with Western culture (Wolf, 1996). Thus, I was connected with local women because of our shared gender but vastly separated by class, race, education, language and culture. In turn, my status as a Western foreigner afforded me the status of a special guest or 'honourary male' in some instances. My perceived status had a direct bearing on the sites of life and livelihood that I was permitted to enter in the village and, consequently, I often played on one or another aspect of my persona in order to ensure access.

Often times my gender won out and I was able to enter and negotiate the spaces of women's productive and domestic tasks; although, on occasion, and especially in Shia homes in Nomal, I was not permitted to interact with women and was instead treated as a special guest. In the prior instance, I was able to enter household enclosures, kitchens and gardens and move about freely within them as community women do. In turn, my status as a woman precluded me from entering men's meetings, the mosque and performing some productive tasks such as ploughing and planting seeds. My increased status due to race, class, education and Western culture, however, allowed me to enter some traditionally male spaces and afforded me greater mobility around the village. I was able to visit the high pastures, use the main roads (women usually use narrow back pathways), talk openly with men on occasion and visit the bazaar when the mood suited me.

The limits placed on my mobility due to gender and the various ways I was perceived in the community resulted in varying experiences between my research participants and myself. How community members perceived me influenced the openness with which we conversed, the information I was given and inevitably affected the 'partial truth' that this thesis represents.

3.5.2 Issues relating to Personal Relationships

As has been discussed, my research relied on the assistance of local community members to carry out fieldwork. This assistance was a necessity and, for the most part, aided my research. However, my close association with these community members further affected how my research was perceived and accepted in the study communities. My affiliation with certain families and religious sects affected the level of trust and openness established between my research participants and myself.

During my stay in Nomal, I lived with an Ismaili family in an Ismaili neighbourhood. However, the village consists of Muslims from two traditions: Ismaili and Shia. The Ismailis are a more lenient sect when it comes to gender issues. Their interpretation of purdah is less strict, they have fewer restrictions on women's mobility and generally believe in the formal education of girls. The Shias, on the other hand, interpret purdah very strictly. Shia women and girls are rarely seen around the village. The result is that Ismailis often perceive and describe Shias as ignorant and backward, and Shias often perceive Ismailis as overly progressive and immodest. These differences have produced tangible boundaries in the community including distinct Ismaili and Shia neighbourhoods. Community activities are generally separated along these lines thereby reducing the interaction between the two communities. This is not to say that no

interaction takes place or that they are openly hostile to one another (although there are some conflicts along these lines) but, rather, that Ismaili households and neighbourhoods are more closely connected with other Ismaili households and neighbourhoods and vice versa.

The division in the community had several effects on the research process. First of all, my association with an Ismaili family in some ways precluded me from interacting to the extent that I wished with members of the Shia community. Research participants were predominantly identified through the connections and associations of my Ismaili hosts. I overcame this limitation to some extent by explicitly asking to interview members of the Shia community. Even then, I felt that interviews with members of the Shia community were not as open as they were with members of the Ismaili community. I cannot be sure whether this difference stemmed from the different level of acceptance of the project in the two communities or from reluctance to discuss matters of village life with someone perceived as being affiliated with the Ismaili community. Similar limitations were encountered in Haldi. However, these limitations stemmed from the association of my field assistants with their extended kin groups and the divisions evident within the village between these kin groups.

3.5.3 Issues of Interpretation and Translation

One of the greatest dilemmas I faced in the field resulted from my inability to speak the local languages and thus converse freely with research participants. The majority of the research work required an interpreter and was not recorded. As a result, I had to rely entirely on another person to pose my questions and translate the answers given by my research participants. Their ability to translate the nuances of either my

questions or the respondents' answers between the two languages affected the transmission of information. The translator may have acted in some ways as a filter and had the power to determine whether or not something was relevant for, or included in, my research.

My inability to speak the local languages limited the amount of unstructured dialogue I could have with research participants. It is for this reason that the interview format was largely made up of semi-structured questions, despite the fact that I would have much preferred to have open and extended discussions with my research participants. My inability to speak directly with my research participants in some ways precluded me from getting the depth of insight that may have been possible through more open conversations.

Another area of concern stemmed from the inability of my translator to give me all the information she/he was receiving from the research participant (and to present concerns in the same order and with the same emphasis). My inability to control this process was a constant source of frustration. Obviously, some information would be left out simply due to the pace at which conversations took place and the inability of the translator to remember all the details. Often times, I became frustrated after hearing a research participant talk for a few minutes only to have my research assistant turn to me and repeat what he/she said in one sentence. The overall effect that translation and interpretation had in altering the information I received cannot be known. My inference is that the effect was significant.

3.5.4 Issues of Resistance

Very infrequently, my effort to conduct research and my presence in the community was met with resistance by local community members. As others have shown, acts of resistance are one way in which the researched can exert their power within the research process (Wolf, 1996). These acts of resistance made me reflect on my own position in the field and the potentially exploitive nature of my research project. The forms of resistance varied, ranging from personal attacks on my local dress for being 'too short' and/or 'too tight', to refusing to answer questions posed during interviews, to not showing up at scheduled meetings. Two of these instances stand out in my mind.

The first act of resistance took place during a scheduled interview with a woman in Haldi. Other studies have shown that subjects can resist and subvert researcher's efforts, making some interviews difficult or even impossible (Wolf, 1996). This was the case in this particular instance; however, the resistance came not from the intentioned research participant but, instead, from her husband. During the interview, the participant's husband came home unexpectedly and sat with us in the kitchen. As I continued with my questions, the man took over the interview commenting, "Why are you asking her? She doesn't know anything?" When I persisted, he took over answering the questions himself commenting continuously that he either had no opinion on the matter or that he did not know.

A second incident involved a meeting in Nomal. The head of my host household had arranged a meeting for me with a local village organization to which he belonged made up of male heads of households. The organization had agreed to meet with me following their meeting. After the completion of the meeting, my host came to escort me

to the meeting place. By the time we arrived, only a few men remained. When my host questioned these men as to where the other men had gone, they informed us that they had left because I only spoke English and would not be able to communicate with them. This explanation seemed insufficient as my host was able to translate and several of the men did speak English.

It is difficult to know why my presence or my research was resisted. Was it my associations within the community? Was it my gender or my foreigner status? Was it the nature of my questions? Needless to say, these interviews did not produce a lot of direct information relevant for this thesis. Indirectly, however, the experiences raised important questions about the research process and the positions of the researcher and the researched in the field. They also emphasize the power that those being researched may exert within the research process. As a consequence of these acts of resistance, this thesis can only present a part of the situation; a situation interpreted from the views of those willing to discuss their opinions and experiences with me.

3.5.5 Issues of Writing and Representing the "Other"

The dilemmas of fieldwork do not end in the field. Many researchers have struggled with issues related to writing about and for the "other" and have attempted to include their research participants in the post-fieldwork process of interpretation and writing (Geiger, 1986; Wolf, 1996). Varying approaches have been experimented with to improve representation including sharing results, co-authorship and presenting texts as "constructed domains of truth" and "serious fictions" (Clifford, 1988, p. 10; Geiger, 1990, p. 178 as quoted in Wolf, 1996).

This issue is of central importance for this thesis. The physical distance and language barrier that separates me from my research participants prevents me from including them extensively in the process of interpretation and writing. The most I can do is provide them with a copy of the information I have gathered. For this reason, I claim this work as my own with all of its misinterpretations, faults and, hopefully, also its insights.

CHAPTER IV: THE IMPORTANCE OF DEBRIS FLOW PROCESSES TO THE KARAKORAM MOUNTAIN ENVIRONMENT

4.1 INTRODUCTION

Natural hazards research has traditionally relied on a sound understanding of geophysical or biophysical agents. As debris flows are the agent under study, a review of current understanding and progress in their investigation is warranted. This section will be followed by a discussion of the Karakoram mountain environment including the role of mass movement and debris flow processes in its former and present landscape development.

4.2 CURRENT UNDERSTANDING OF DEBRIS FLOW PROCESSES

A flow is one of three main types of mass movement processes and may be defined as lacking a sharply defined failure surface with shear being distributed throughout the moving mass (Carson and Kirkby, 1972). Shear is usually at a maximum at the base of the flow and all movement occurs as differential movement within the body of the flowing mass. Movement may stop on reduced gradients or may continue until the driving forces are reduced (i.e., at the end of a storm). Debris flows are distinguished from other types of flow, such as earthflows and mudflows, by the nature of the materials in motion, the former involving coarse-grained materials mixed with clay and water (Selby, 1993), and the nature of the flow itself, which is rapid, transient, and includes a steep front mainly constituted of boulders (Laigle and Coussot, 1997).

Debris flows develop where there is an abundant source of material that can be mobilized by the addition of water (Selby, 1993). In mountains, glacial, fluvial, talus and other debris deposits add to the possible source materials, while water may be introduced through intense and/or prolonged rain events and through snowmelt. However, processes are usually limited in one of these dimensions; that is, they are either transport-limited or weathering-limited. The material loosened from hillslope bedrock by weathering is moved downslope by transport processes. If transport processes are more rapid than weathering, then only a thin soil cover will develop, as debris is being transported downslope at a faster rate than it is being weathered. On the other hand, if weathering rates are more rapid than transport processes, a soil cover develops and the movement is said to be transport-limited. This distinction is important to an understanding of hillslope development (Carson and Kirkby, 1972).

Debris flows are a common mass movement process occurring in a wide range of mountainous environments. Much research has been undertaken regarding the incidence, triggering mechanisms, magnitude and frequency of debris flow events. These parameters are useful to hazards' studies. In fact, the justification for studying debris flows and other mass movement processes is often related to their potentially hazardous nature: "high-magnitude events are part of a dynamic equilibrium and thereby represent a basic risk for life, settlements and installations in cold mountain areas" (Haeberli, 1996). Research efforts, however, have concentrated on understanding the geophysical process and have largely ignored the consequences of these geophysical processes for mountain communities.

The magnitude and frequency of debris flow events is integral to an understanding of debris flow hazard and the likelihood of a disastrous event. Studies have employed varying methods such as lichenometry (Winchester and Harrison, 1994; van Steijn, 1994), dendrochronology (Hupp *et al.*, 1987; Baumann and Kaiser, 1999), soils analysis (Liebens and Schaetzl, 1997) and dissolution pitting of carbonate boulders (Hereford et al., 1998) to determine dates of debris flow events, or to determine relative ages in comparison studies, with varying success. Dendrochronology and dissolution pitting appear to produce reasonable dates for debris flow activity; however, all four techniques (including lichenometry and soils analysis) are probably best used as relative, rather than absolute, indicators. The dynamic nature of the environment where debris flows occur often results in subsequent censoring of debris flow deposits and datable material. Therefore the method employed to determine the age of deposits is only as good as the amount and distribution of datable material available for analysis.

Other studies have attempted to identify triggering mechanisms for debris flows, with most suggesting intense rain events, snowmelt runoff, or a combination of the two as the predominate trigger. This is another important aspect of hazard mitigation and assessment. Anderson and Sitar (1995) examine rainfall-induced debris flows from a soil strength perspective attributing their initiation to a loss of material strength due to rising pore water pressures.

Meteorological and climatic data has also been related to debris flow initiation through the determination of threshold conditions. Rebetez *et al.* (1997) found a clear relationship between a critical threshold of precipitation (relatively defined as a standard deviation level and a duration) and the triggering of debris flows. No debris flows were

triggered below this threshold, however, two precipitation events which exceeded the critical threshold of precipitation did not have associated debris flows. This is presumably due to a lack of available sediment. Church and Miles (1987) come to a different conclusion in their study in southwestern British Columbia:

> the circumstances that trigger debris flows are complex, involving contingent conditions on the ground as well as a hydrometeorological "trigger". We conclude that traditional hydrometeorological indices based on routine meteorological measurements are unlikely to provide consistent indications of the likelihood for debris flow to occur. (p. 78)

Indications from both of the above studies further point to an increase in the number of debris flow events in recent years. Rebetez *et al.* (1997) found that the number of extreme rainfall events capable of triggering debris flows has increased over the last three decades in the Ritigraben region. Church and Miles (1987) similarly found that there was an increase in the incidence of debris flows over the past decade in southwestern British Columbia although no clear meteorologic correlation could be made.

In recent years, considerable literature has been published on debris flow model experiments and numerical modeling of the debris flow process (Liu, 1996; Bathurst *et al.*, 1997; Laigle and Coussot, 1997; Major, 1998; Hungr, 2000). With respect to deposition, computer numerical modeling, based on hydraulic theories, has been used to simulate debris flow depositional processes. If the initial movement parameters are known, such as flow velocity, discharge, flow depth, resistance coefficients, etc., the depositional extent of a debris flow may be determined. However, this information is

difficult to determine, making numerical modeling a tool for post-evaluation of debris flow disaster, rather than a predictive one (Liu, 1996).

Experimental studies have shown that strongly aligned, imbricate fabric can develop rapidly over short distances in debris flows, providing strong evidence that deposits form predominately through progressive incremental accretion rather than through en masse emplacement (Major, 1998). Pebble long axes were found to align subparallel to deposit margins as well as subparallel to margins of surge waves arrested within deposits (Major, 1998). Hungr's (2000) study using the theory of uniformly progressive flow supports Major's findings. The study shows that non-homogeneity can cause very significant magnification of the peak discharge in debris flows, depending on the slope angle and on the length of the frontal boulder concentration, contributing to surges and longitudinal sorting within debris flow deposits.

Also of interest to our understanding of debris flow hazard is the literature pertaining to the morphology and sedimentology of specific debris flow events. Some studies have focused on source area morphology, failure mechanisms and sediment deformation during the flow process (Nicoletti and Parise, 1996; Masson *et al.*, 1997; Masson *et al.*, 1998), while others have focused on resultant sedimentology of depositional features (Vallance and Scott, 1997; Blair and McPherson, 1998; Blair, 1999; Sohn, 2000). Studies of this type have been particularly difficult in the Himalayan region due to the polygenetic nature of many landforms and the difficulty encountered in discriminating between diamicton of different origins.

4.3 Characteristics of the Karakoram Mountain Environment

Mountain landscapes have often been addressed separately within the field of geomorphology. This reflects the relative, rather than absolute, differences separating mountain systems and other subaerial conditions, specifically their high relief, steep slopes and altitudinally varying local climates (Hewitt, 1972; Hewitt, 1984). These characteristics of the mountain environment result in a high-energy condition (i.e., higher relative denudation rates and extremes in climatic conditions such as temperature and moisture availability) and distinctive morphologic features (Hewitt, 1972). However, the nature of the mountain environment and the processes acting within it vary widely between and within individual mountain ranges.

The regional geomorphology of the Himalayan region has been described with increasing attention over the past decade (Derbyshire *et al.*, 1984; Goudie *et al.*, 1984; Fort, 1987; Shroder, jr., 1993; Shroder, jr., *et al.*, 1993; Owen *et al.*, 1994; Sharma and Owen, 1996; Lehmkuhl *et al.*, 1998; Richards *et al.*, 2000; Hewitt 2001; Hewitt, 2002). Most studies rely heavily on visual inspection of landscape features providing little sedimentological and/or geomorphological data to support their interpretations. Consequently, the accuracy of these interpretations has recently come into question. It is important to note that our understanding of the geomorphology and landscape development of the Karakoram region is continually evolving.

The Himalayan range is a result of the ongoing collision of the Indo-Pakistani plate with the Eurasian plate (Shroder, jr. et al., 1993). The geomorphology and Quaternary development of the area is characterized by extremes of altitude, relief and geomorphic process resulting in rapid erosion and thick valley-floor sedimentation. The

present landscape has been sculpted by various glacial, fluvial, mass movement, lacustrine and oceanic processes resulting in some of the greatest relief and largest drainage basins and glaciers on Earth (Owen and Derbyshire, 1993; Shroder, jr., 1993).

The combination of high denudation and uplift rates has resulted in an enormous relative relief with valley floors averaging 1500 m in altitude and peaks lying 7000-8000 m above sea level. The climates of the region are transitional between central Asian and monsoonal south Asian types, varying considerably with altitude, aspect and local relief (Owen, 1991). Hewitt (1989) shows that as a result of such enormous relief and extremes in climate, there is a relatively well-defined altitudinal organization of geomorphic processes and depositional environments within the Karakoram Mountains. Four altitudinal zones are identified:

(i) Zone I: Perennial ice climate, generally > 5500 m altitude;

(ii) Zone II: High alpine tundra (humid), ~4000-5500 m altitude;

(iii) Zone III: Subalpine/montane (seasonal drought), ~ 3000-4000 m altitude; and

(iv) Zone IV: Submontane/cool steppic (semi-arid), generally < 3000 m altitude.

Zones III and IV support the majority of mass movement activities (with the obvious exception of avalanches), including rockwall processes and most flow processes such as debris flows, slump-earthflows, and mudflows. Depositional features evident in the landscape are largely a result of climatic and geomorphic activity within these zones (Hewitt, 1989). Prior glacial activity that has steepened valley sidewalls and left large deposits of easily mobilized debris predisposes this environment to large depositional features such as sediment fans and talus cones.

Studies of mass movement in the region have been more heavily concentrated on process (Derbyshire, 1984; Hewitt, 1988; Hewitt, 1989; Hewitt, 1998b; Hewitt 1998c; Shroder, 1998; Hewitt, 1999; Hewitt, 2001; Hewitt, 2002), and rates of process (Owen and Sharma, 1998; Shroder, Scheppy and Bishop, 1999), than on the description of depositional features (Owen, 1991; Iturrizaga, 1999), although both types exist in the literature. Mass movements of varying types have been identified and described in the Karakoram Himalaya. Owen (1991) identifies eight main categories of mass movement, namely: rockfalls, avalanche, rockslides, debris flows, flowslides, rotational slips, slump and creep. Debris flows and flowslides are identified as the most common and important processes for the Karakoram depositional environment.

Mass movements are ubiquitous in the Karakoram due to active tectonics, extensive glacierization, precipitation and snowmelt inputs, and high relief providing long, steep slopes. The largest slope failures are attributed to undercutting by strongly erosive rivers and pressure release in oversteepened rock slopes following glacial retreat (Owen and Sharma, 1998). Many have been catastrophic (Hewitt, 1988, 1998, 1999) leading to the damming of major river courses and streams and subsequent release of water as glacial outburst floods (Brunsden and Jones, 1984; Vuichard and Zimmerman, 1987). Such events are capable of rapid and violent erosion and widespread resedimentation of unconsolidated debris deposits, which may dramatically reshape the landscape (Owen and Derbyshire, 1993).

The importance of mass movement events to the overall denudation of the Himalaya is suggested to be as a delivery mechanism of the majority of sediment subsequently removed by glaciers and rivers, the main eroding and transporting media

(Shroder, jr., 1998). Shroder, jr. (1998) suggests that mass movements may be the major processes shaping the landscape at present, although the relative importance of mass movement processes to the overall denudation of the Himalaya is still poorly understood and must be further accounted for in actual and potential denudation.

Accounting for the present rate of denudation by various processes has been difficult due to secondary debris accumulations redeposited from glacial sediments. These accumulations give the impression that recent debris supply is much greater than it actually is (Iturrizaga, 1999). Closer examination of landscape features indicates that present-day primary debris production from bedrock is not sufficient to produce the immense debris accumulations common in the Karakoram. Instead, they illustrate the close connection between debris accumulations and prior glacial phases—inexplicably large debris accumulations result from the resedimentation of glacially deposited materials such that contemporary resedimentation of glacial debris is several times greater than the production of new debris (Iturrizaga, 1999).

The importance of mass movement processes in shaping the Himalayan environment is further confused by a lack of sedimentological studies, and rarely any concerning the sedimentology of glacial and non-glacial diamicton (Owen, 1994). Great difficulty exists in trying to separate processes of differing origins. Intense fluvial and glacial erosion has dissected and destroyed diagnostic morphologies in many places, such that tills are frequently mistaken for debris flow deposits and vice versa (Owen, 1994). This is particularly difficult when mass movement deposits contain material either directly or indirectly derived from glacial ice or from reworked and resedimented tills as described above. No one characteristic can be used to determine the genetic origins of a

particular diamicton. Instead, several methods should be used to determine diamictons of different origin, including field mapping and logging, particle size analysis, macro-and microfabrics analysis, clay mineralogy, geotechnical analysis, and micromorphology (Owen, 1994).

These problems are augmented by a lack of accurate and appropriate dating techniques to reliably quantify the absolute rates of change and landscape modification. Although a wide array of dating techniques are available to researchers, the expense of absolute-dating techniques and the difficult sampling problem encountered in the highly active Himalayan system result in relative-age dating techniques comprising an integral role in Quaternary environmental reconstruction. The reliability of relative dating techniques has been found to be highly variable introducing difficulties in cross-comparison of regional studies (Sharma and Owen, 1996).

4.4 Conclusion

This chapter briefly introduced the characteristics of debris flows, the primary geophysical process under study in this thesis. Debris flows have diagnostic attributes that allow them to be identified in the field. They also have identifiable characteristics important in human terms including magnitude, frequency, duration, time of onset and temporal spacing. Heavy or prolonged rains trigger most events in regions with significant weathering rates or with considerable amounts of available, entrainable material. Debris flows play an important role in the landscape evolution of mountainous areas and the Karakoram mountain environment is no exception. Debris flows are

important erosional and depositional agents that shape the local landscape. They are particularly relevant for this study due to their role in sediment fan progradation.

CHAPTER V: DIFFERENTIAL VULNERABILITY TO DEBRIS FLOW HAZARD IN NOMAL, DISTRICT GILGIT

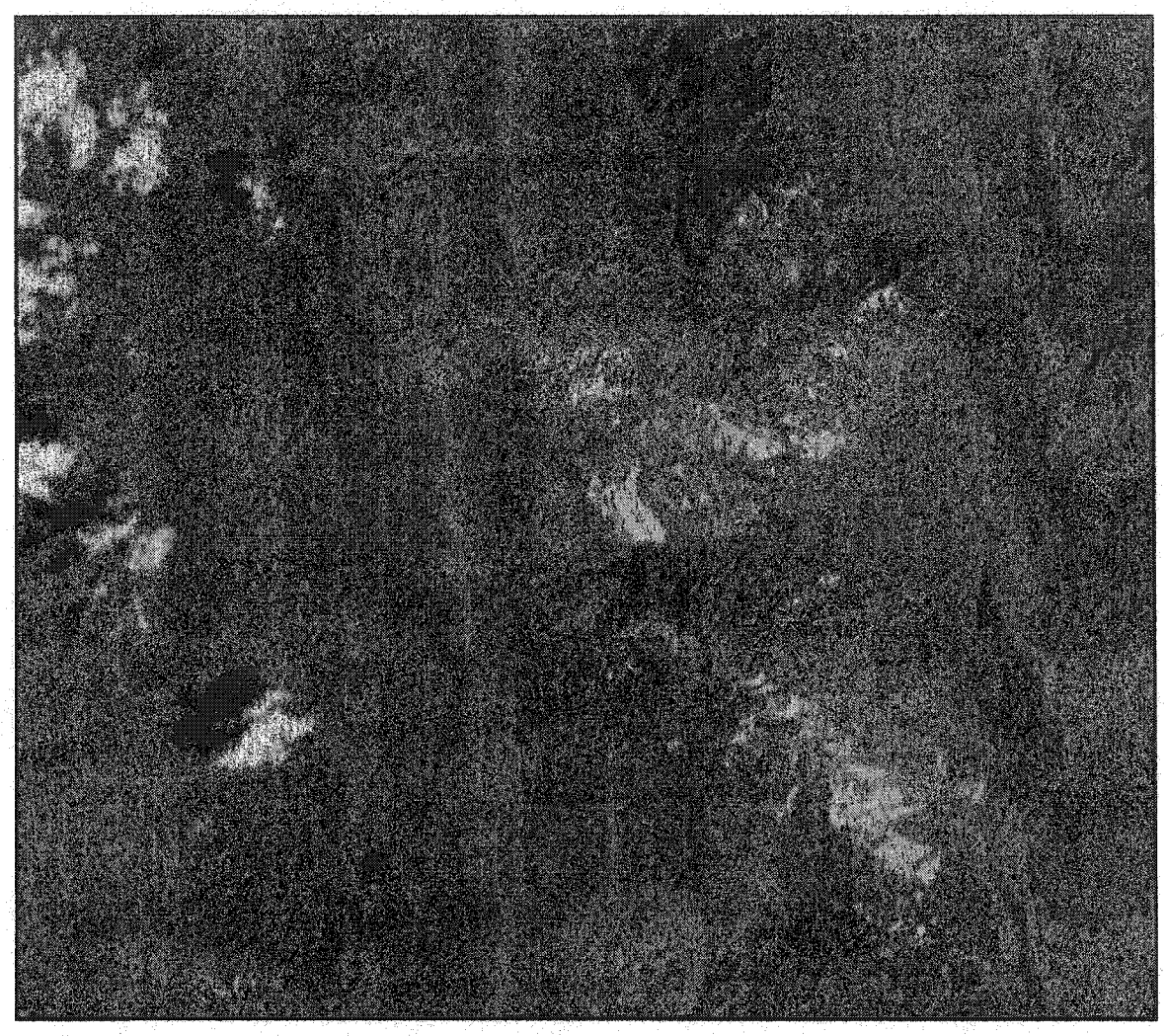


Figure 5.1: Landsat 7 ETM+ satellite imagery showing the village of Nomal on the right.

5.1 Introduction

The physical isolation and increased potential for damaging events resulting from steep slopes and rugged terrain in the Himalaya, have brought about a myriad of cultural adaptations to environmental fluctuations in local resource management systems – the extent of which researchers are only now beginning to appreciate (Rhoades and Thompson, 1975; Bjonness, 1986; Clemens and Nusser, 1997; Pilardeaux, 1997; Schickoff, 1997; Jodha, 1998; Ellis-Jones, 1999; Jodha, 2000; Gardner, 2001). Indeed, mountain communities have proven, time and time again, to be well-adapted to the 'normal' condition of environmental variability in mountain lands, and self-sufficient and resilient in the face of damaging events.

The recent extension of lowland policy into mountain lands for administrative control, strategic military purposes and recreational use is having serious implications for local resource management systems and their resilience to damaging events (Price, 1999). The building of roads and the resulting increased access to commercial resources and markets, coupled with the introduction of the cash economy and increasing opportunities for off-farm employment, particularly for men, have brought about many changes as small communities slowly become integrated into the larger global market economy (Thomas-Slayter and Bhatt, 1994). These changes are affecting village unity and access to resources and are thereby affecting the resiliency of local resource management systems.

The next two chapters will provide detailed case study analyses of two communities in Northern Pakistan. The purpose of these chapters is to illustrate how differences in socio-cultural organization and access to resources produce differences in

vulnerability and social responses to environmental constraints. This is particularly important for a region such as Northern Pakistan, which is often thought of as static, 'backward' and homogeneous. Instead, these chapters will demonstrate the dynamic nature of 'traditional' societies, and more specifically, examine how incorporation of modernization processes into community life is affecting the ability of villagers to cope with environmental constraints.

This first case study is based on the village of Nomal, District Gilgit, Northern Areas, Pakistan.

5.2 Physical and Social Setting

Nomal is a village of five distinct agricultural communities located on the true right side of the Hunza valley (See Figures 5.1 and 5.2). The Naltar valley lies to the north and the Hunza River valley to the east. Steep, sometimes vertical walls of over 1000 m relief surround the village on the west and south sides. The permanent settlements are situated on a series of alluvial fans and river terraces, as well as on the floodplain of the Hunza River (See Figure 5.3 and Plate 5.1). Most landholdings within the village are small, averaging about one hectare per household, and are scattered around village land in several parcels.

Nomal is a double-cropping area due to a relatively low elevation, a warm climate and a long growing season. Potatoes (aloo) and wheat (gur) are planted in March and harvested in late June. The lands are then quickly ploughed so that corn (makai) may be planted for harvesting in October. The irrigated areas also produce fruits and nuts, including apricots (droo), apples (balt), plums (gurdaru), figs (pac), cherries, almonds

(badam), apricot kernels (girri) and walnuts (akhrot). These are grown for personal consumption, barter and commercial sale.

Figure 5.2: Location map of Gilgit District, Northern Areas, Pakistan. Nomal is located directly north of Gilgit along the Hunza valley (adapted from Butz, 1993; Halvorson, 2000).

The majority of fodder crops are grown outside the area of permanent settlement on an extensive plateau situated some 900-1200 metres above and to the west of the village (See Plate 5.2). This higher, flat terrain is the result of a very large rotational landslide and infilling by stream, debris flow, aeolian, and lacustrine deposits (Hewitt, 2001). Lakebed deposits measure 20 metres in depth in some places, providing an ample soil base for fodder cultivation.

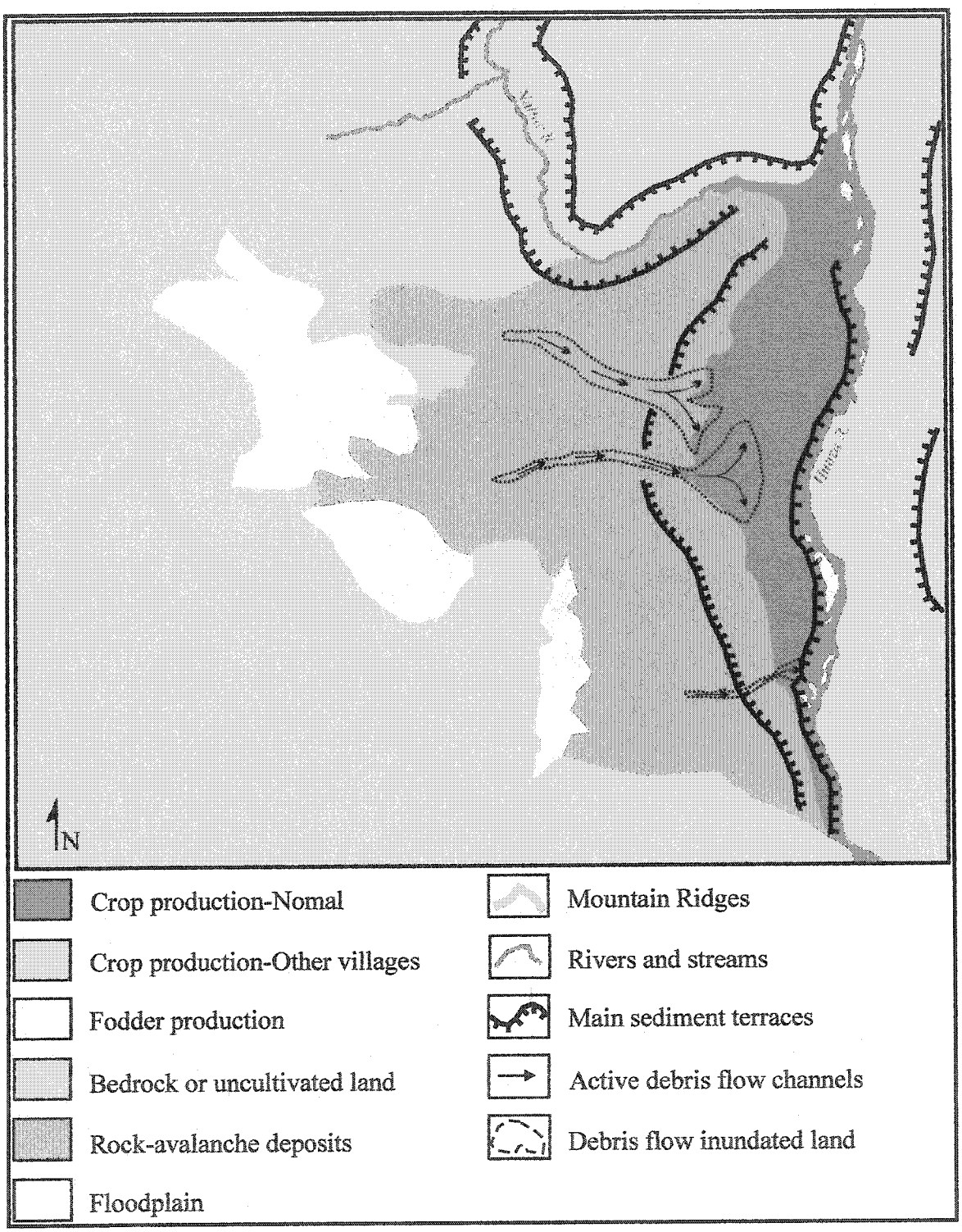


Figure 5.3: Sketch map of Nomal showing major landscape features and the location of productive lands (based on Landsat 7 ETM+ satellite imagery and field observations).

Water for irrigation is provided by a number of springs but in small quantities owing to the limited catchment area—otherwise this could have been a substantial cropping area as well. Due to the distance of the plateau fodder areas from the main village, boys and young men, who also care for livestock at this location, are the primary attendants of these fields. Women often travel to this location only at the end of the fodder-growing season to cut grasses and leave them to dry. Mules are used to bring the dried crops down to the village to be stored until the winter months when livestock are stall-fed.

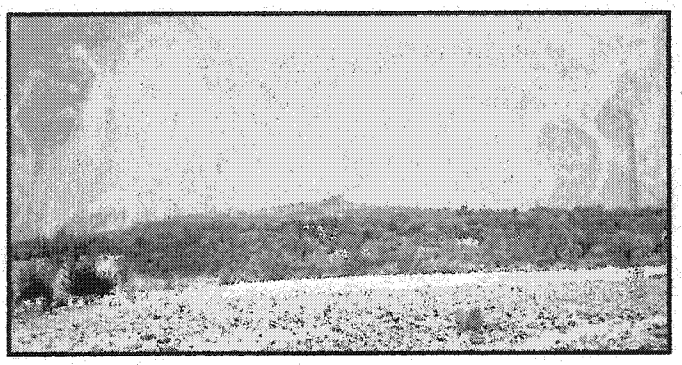


Plate 5.1 (left): Permanent settlement in Nomal is situated on a large polygenetic sediment fan and the river terraces of the Hunza River.
Plate 5.2 (right): The majority of fodder is grown outside the area of permanent settlement on an extensive plateau to the west of the village.

The village economy is supplemented by animal husbandry. Livestock include cattle, oxen, goats, sheep and mules. At the household level, livestock provide milk, wool, animal hair, leather, and occasionally meat. At the farm level, oxen and mules provide draught power for ploughing, threshing and land development. A very important effect of village livestock is to produce manure to fertilize fields (Whiteman, 1985). The village has several high pastures, the most important being Chotal Gotomb, an Isma`ili high pasture adjoining the fodder fields (See Plates 5.3 and 5.4) and, Bala Naltar, a settlement situated half-way up the Naltar valley. All livestock, with the exception of a

few animals kept in the village for milk or sick animals, are taken to the high pastures from April until October.

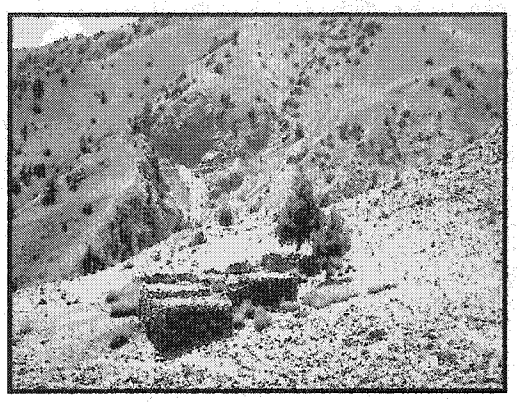


Plate 5.3 (left): Chotal Gotumb, an Isma`ili high pasture, is used from April to October to graze village livestock.
Plate 5.4 (right): A shepherd leads his flock of goats in the high pasture of Chotal Gotumb.

Care of grazing livestock is the duty of men, although young men who have finished school and elderly men usually carry out the occupation. There is little infrastructure associated with the high pastures, as they are located 3 to 6 hours by foot from the area of permanent settlement. The shepherds usually alternate their time in the high pastures with other kin members on a 3 to 4 day rotation, allowing food to be brought up from the village. A few traditional mud, wood and stone buildings dot the high pastures landscape. These structures house the shepherds and their livestock during the summer months.

5.3 Hazard History

Nomal has experienced several damaging events over the past 40 years of varying magnitude, frequency, time of onset and duration. They range from a high magnitude,

rapid onset glacial-lake outburst flood in 1960 and increasingly frequent and variable debris flows, to slower onset, more pervasive hazards such as a general lack of water to cultivate fields. This section details the characteristics of these various hazards including their magnitude, frequency, duration, areal extent and temporal spacing. Since each hazard event has its own distinctive characteristics, each has some differing effects on the village community. Examining the relationship between hazard event characteristics and the socio-cultural vulnerability of villagers can identify those most at risk.

5.3.1 Debris Flow Events

Nomal is situated on the site of the largest identified rock avalanche complex in the western Karakoram (Hewitt, 2001). The complex is derived from the collapse of the west wall of the Hunza valley. The original deposit blocked the Hunza and Naltar valleys in their entirety, explaining the upstream orientation of the present-day confluence of the Naltar and Hunza Rivers (Hewitt, 2001). Approximately 15 square kilometres, or half of the original extent of debris cover, remains today, bordering the west side of the village for some 5 km and rising 900-1200 m above village elevation. This remaining debris is very unstable as it is composed mainly of uncemented, crushed and powdered rock. It is easily mobilized during heavy precipitation events, which are common in the summer months, and is the source material for repeated debris flow events affecting the village (Hewitt, 2001).

Debris flows are a common, recurring hazard in the village of Nomal. Surrounded on the west side by steep terrain and loose entrainable material from rock-avalanche and talus deposits, heavy rains produce high magnitude, short-duration events that give the villagers little time to respond. The largest debris flow event in recent history occurred in

the summer of 1976 crossing the entire width of the village to enter the Hunza River. Since this high magnitude event, several other debris flows have followed the same channel and/or created new channels in the same general area. More recent debris flow events have occurred in the months of April through October in the years 1988, 1992, 1995, 1997, and 1998.

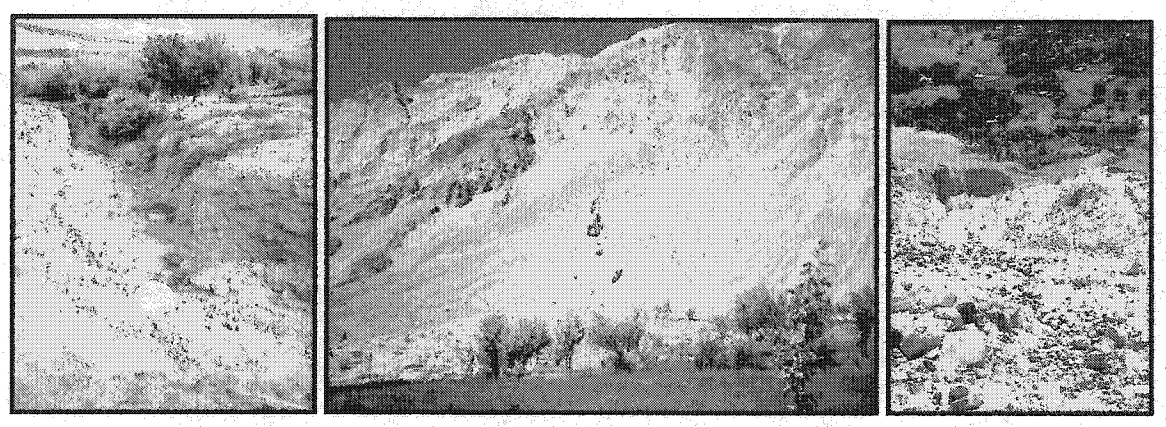


Plate 5.5 (left): The large gully formed by the high magnitude debris flow event of 1976 passes through the entire width of the village to enter the Hunza River.
Plate 5.6 (centre): Recurrent debris flow events originate from the steep terrain and readily entrainable rock-avalanche and talus deposits to the west of the village.
Plate 5.7 (right): A downward-looking view of the debris flow channel that affects village lands on the western fringe of permanent settlement.

As a result, households have experienced loss of life, homes, livestock, cultivable land, crop yields, and in the longer term, income and wealth. Many households have been repeatedly affected by debris flow events, even after moving their homes, while others have farmed for decades without ever being affected. Still others have just recently started to be affected by debris flow events (See Appendix B, Table A2.1)

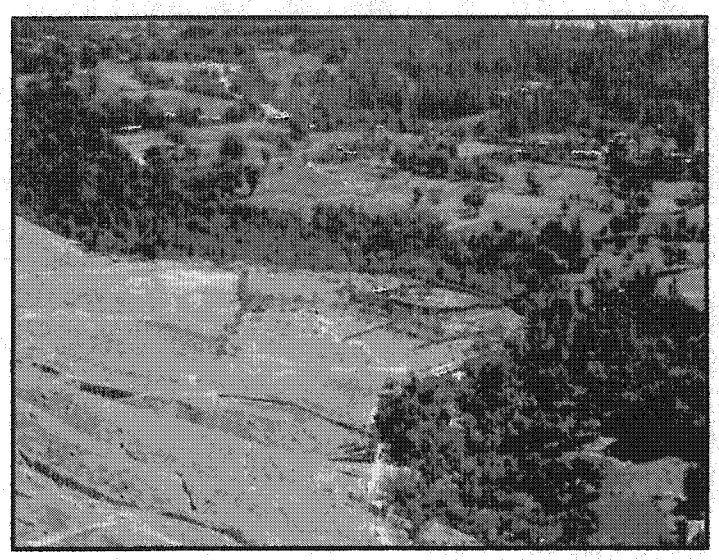
The highest magnitude event in recent history occurred in July 1976 after heavy rains. A large gully was formed from the source area in the steep cliffs above and passing through the centre of the village to the Hunza River (See Plate 5.5). In this particular

event, eleven houses and three lives were lost. A mother, her young son and her mother-in-law were unable to escape their home in time and were consequently buried beneath the wave of mud and boulders flowing through the village. This was a particularly devastating event given the loss of life, yet the residents remained in the village and rebuilt their houses in new locations. The land inundated during this event has since been reclaimed, and wheat fields line the deep gully that still passes through the village.

More recent events of lower magnitudes have occurred in 1988, 1990, 1992, 1995, 1997, 1998. These debris flows have affected only the westernmost part of the village. Those villagers who own land in this area have been repeatedly affected (See Plates 5.6 and 5.7). Presently, to avoid losses of valuable crops, only fodder crops and fruit trees are planted. The latter are able to withstand considerable forces without being destroyed. However, most research participants attribute the lack of valuable crops planted in this area to the lack of water, rather than as a specific response to, or avoidance of, damage from debris flow events (See Plates 5.8 and 5.9). Residents have asked the government for money to build an irrigation channel to supply water to these lands. If such a project was implemented, and cultivation of valuable crops was extended and intensified, more difficulties could be encountered due to the propensity for debris flows in this area.

The last damaging event in the village (as of 2001) occurred in the summer of 1998. This debris flow first followed the link road within the village and then veered off into a residential area. One man, whose home was destroyed by the debris flow event, said the water rose so quickly in his enclosed garden that he narrowly escaped being swept away by the force of the water by jumping the fence. He also spoke of large

boulders hitting the house and coming in through the windows. These boulders were the cause of much of the destruction, a typical feature of the debris flow hazard.



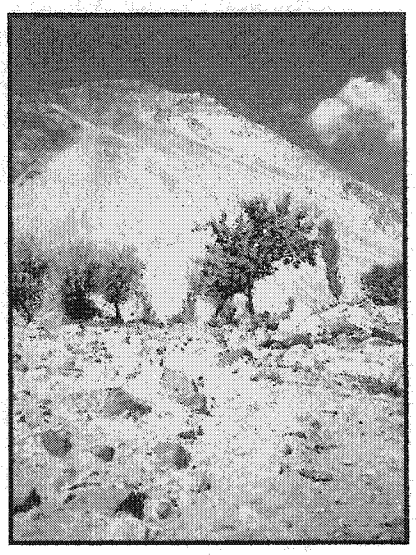


Plate 5.8 (left): The westernmost fringe of permanent settlement has remained uncultivated due to a lack of water for irrigation, not as an explicit risk-avoiding strategy. **Plate 5.9** (right): Village lands affected by debris flows are usually used to grow fruit trees and fodder crops.

In total, four or five houses were damaged and several hectares of land under cultivation were lost due to inundation with muddy water that quickly cemented over crops. Many fruit trees were lost. The part of the land that was not strewn with boulders was reclaimed to cultivate wheat. The rest was not reclaimed, as the boulders were too big to move. They now grow fodder crops and trees in the space between the boulders.

Residents of the community have attributed the occurrence of debris flows to heavy and prolonged rainfall events, often accompanied by thunder and lightning. Several respondents described the events as being caused by lightning hitting the surface of the earth and splitting it apart. Such rainstorms usually occur in the summer months, making this the peak time for debris flow events. However, within the 4 to 5 month time frame (approximately from May to September/October), there appears to be no particular

pattern to the occurrence of heavy rains and resultant debris flows. As a result, they are sudden, unpredictable events for the community.

Debris flows have been described by eyewitnesses as a combination of coarse debris, water, and big boulders moving at great speeds. The cause of damage to homes is attributed to the velocity of flow coupled with the entrainment of coarse debris. However, the deposition of thick debris covers and large boulders is particularly damaging to crop lands, considerably reducing their ability to support agriculture. In many cases, fodder crops or fruit trees are planted in place of agricultural crops to reclaim affected areas. The replacement of food crops with fodder crops is partly due to the diminished quality of the land, and partly due to transferring cultivation of more valuable crops to less vulnerable locations.

For some areas within the village, debris flows were reported to be a relatively new occurrence. Many residents have lived and farmed in these areas without incident for decades. One research participant had lived on his land since 1968 without being affected by debris flow events until the summers of 1997 and 1998, when they occurred in consecutive years.

5.3.2 Flooding Events

The Hunza River borders Nomal on the east side. The main river channel is incised in valley fill. Seasonal fluctuations in discharge rarely affect the village, most of which is perched 50-100 m above the river water level. However, a high-magnitude glacial-lake outburst flood did occur in July 1960 after a glacial dam formed and was later breached in the headwaters near the village of Shimshal. The dam was formed when a valley glacier surged forward and blocked the valley. Glacial meltwaters trapped behind

the dam created a large lake. These meltwaters were later released when the ice dam was breached. Many villages situated along the banks of the Hunza River were affected. Lateral erosion of the river channel was considerable in some locations; villagers estimate that the river terrace at Nomal was cut back 1 km from its former location.

The glacial-lake outburst flood came very quickly and without warning and changed the course of the river. The Hunza River now flows in a different path, which has resulted in continued undercutting of the bank and further losses of cultivable land. The river terraces were under cultivation at the time of the flood and crop losses were great. Two village men, who were near the water's edge when the wave of water descended the river valley, were also lost in this event.

In June 2000, news had traveled down the valley that a similar ice dam had formed at Shimshal as a result of a large block of ice being wedged at a narrow point of the river channel. The ice dam created a lake 2 to 3 times the area of Nomal. Attempts were made to release the water slowly by blasting the ice but these efforts were unsuccessful. A military helicopter monitored the situation daily and could have provided a warning to residents downstream in the event of a breach. However, there is no guarantee downstream villages would receive warning in time due to the rapidity of these events.

An event of similar magnitude to the 1960 event would be detrimental for Nomal and would result in further undercutting of the river terrace. In addition, a significant portion of the Hunza River floodplain has been reclaimed for crop production since the 1960s. This cultivated land is at a much lower elevation than most village lands and would certainly be inundated by floodwaters (See Plate 5.10).

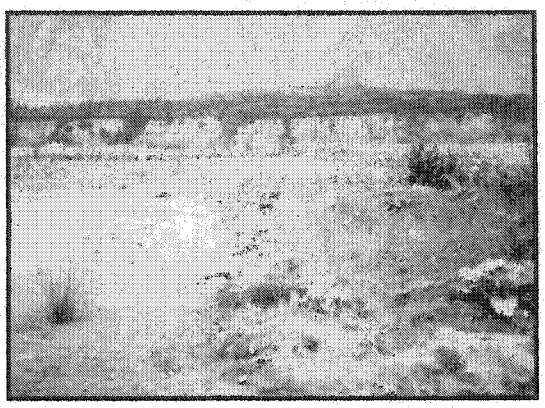


Plate 5.10 (left): Nomal villagers are reclaiming the floodplain of the Hunza River for crop and fodder production.
Plate 5.11 (right): Lower Jutal is a relatively new settlement located on the Hunza River floodplain that is particularly vulnerable to glacial-lake outburst floods.

The impacts of such an event would be particularly devastating for other villages along the valley. The village of Lower Jutal is located on the true left side of the Hunza River, directly opposite Nomal. Residents of the Nagar region, who were facing land constraints in their native village, established the village in the 1980s. Permanent settlement is situated on the floodplain of the river, only metres away from and above its fast-flowing waters. Residents of the village were aware of the flood hazard when they settled in the area but say they had little choice of leaving Nagar or of where to resettle, as uninhabited land is very scarce in the region. However, the location of the village adjacent to the Hunza River is not without its benefits. River water provides an unending supply of irrigation water, and coarse material deposited out of river flow can be used to make fences and cordon off fields. The remaining fines are slowly transformed into soil through successive attempts at crop production (See Plate 5.11).

During the ice dam event of 2000, the rumour of a 15- to 30-foot wave resulted in the evacuation of the residents and livestock of Lower Jutal to the caves above the village. Residents were very anxious about the situation. In fact, one man commented that

they were so nervous they could not digest their food. Despite these evacuation measures, an event similar in magnitude to the 1960 glacial-lake outburst flood would certainly wipe out all homes and crops in the village as well as years of hard work reclaiming land from the river and building livelihoods. Fortunately, such an event did not occur. The glacial lake in the Shimshal valley drained slowly.

5.3.3 Other hazards

More chronic, slower onset problems include a lack of water for irrigation and subsequent heat stress on crops (Hewitt, 1983a). Generally, a lack of water in the summer months relates to inadequate snow accumulation in the more humid, high-altitude zone during the previous winter season (Butz, 1987). A run of years with low snow accumulation in this zone can be particularly devastating for villages on the valley floor. Nomal is no exception. The village relies on meltwater for crop and fodder irrigation and deficiencies can significantly reduce annual crop yields.

Less notable hazards are windstorms, which, up to this time, have had a relatively localized and minor affect on the community. However, in recent years, residents have begun to grow fruit as a commercial crop to sell in the bazaars of Gilgit. It is probable that as villagers become more reliant on the income generated by fruit sales, damage to fruit trees will affect their livelihoods to a greater degree thereby making villagers perceive windstorms as a more significant hazard. Some residents who have already been affected have begun supporting their trees with wooden stakes to prevent wind damage.

Environmental change is also an issue raised by some villagers who report a noticeable change in the climate over their lifetime. They say that it used to be much hotter in the 1940s and 1950s, so much so that their feet would 'burn' when they

irrigated. A cooling trend has resulted in a shorter growing season for the community. Residents must hurry the transition between the first and second crops of the season to ensure that the second crop matures before the occurrence of autumnal frosts.

5.4 Social Organization and Vulnerability

The community of Nomal is made up of approximately 700 households and 4000 inhabitants of two distinct cultural and religious backgrounds. Separation is evident within the village between the Twelver Shi`i and Isma`ili sects. The former comprise about 500 households whose members live predominantly in the neighbourhood of Nomal Centre. The latter comprise about 200 households who live in the neighbourhoods of Bala Aminabad, Paiyin Aminabad, Sadrudinabad and Madina-tul-karim (See Figure 5.4). The Shi`i community has been in the area for centuries while the Isma`ili community arrived much later. Originating from the Hunza region, the Isma`ili people began settling the area in the 1940s after land became scarce in their homeland. The settlement pattern reflects this later emigration. As the more central lands were already in use by the Shi`i, the Isma`ilis settled mainly in the northern and southern portions of the sediment fan.

The Isma`ilis divided from the Twelver Shi'ites in 765, after the death of the sixth Imam (Daftary, 1998). The Isma`ilis decided to follow the late Imam's second son, Isma'il, whose descendants are still represented today in a highly revered leader called the Aga Khan. The current leader is the 49th Imam, Prince Karim Aga Khan IV, who became Imam in 1957 (Daftary, 1998). The practice of Islam by the two sects involves different expressions of religious fervor; the Shi`i are the more orthodox sect of the two.

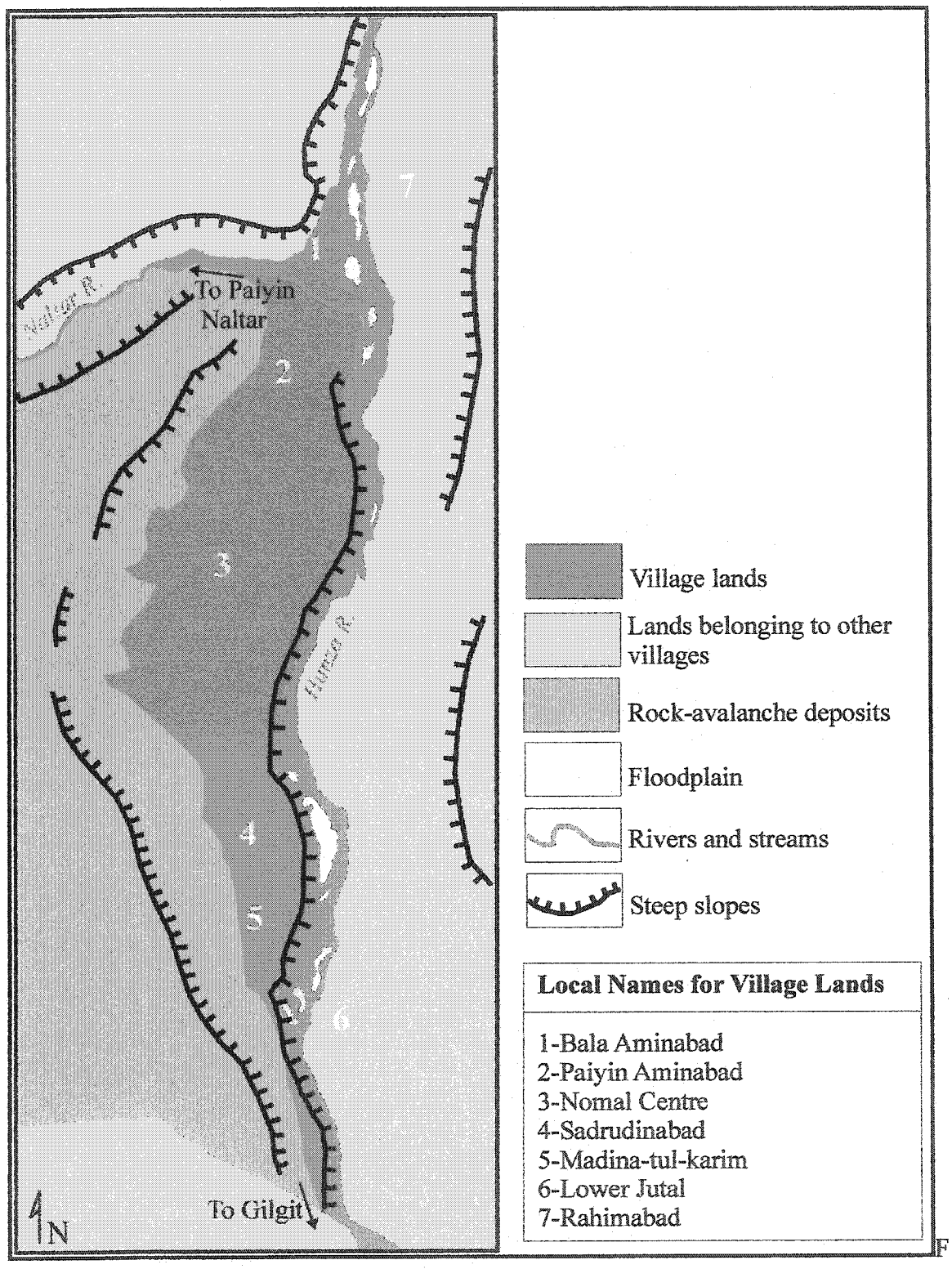


Figure 5.4: Social map of Nomal showing local names for village lands.

They also come from different language traditions, the Shi`i speaking the Indo-Aryan Shina language and the Isma`ilis speaking the Burushaski language. Despite their differences, these two communities have lived together for over 50 years with minimal difficulties.

5.4.1 Village-scale vulnerability

At the village level, differences between the two main religious sects are having an effect on vulnerability. As a whole, the Shi`i community has remained more traditional and has been less welcoming of modernizing influences within their community. They have also lived in Nomal for centuries and seem to have lost most of their social ties to other communities (with the exception of non-local marriage ties). The Isma`ilis, on the other hand, emigrated to the area more recently and still have strong social and kin ties with households in the Hunza region and Gilgit. The community has actively sought out modernization initiatives in response to a call for development from their spiritual leader, the Aga Khan (Daftary, 1990; Daftary, 1998).

The varying acceptance of modernization processes has resulted in somewhat of a socio-economic separation between the two communities. The majority of Isma`ili families educate both boys and girls, seek high-paying off-farm employment for educated men (and sometimes women) and produce commercially valuable crops and fruit to be sold in Gilgit. All of these practices earn money and increase the social linkages of individual households and the entire community. By pooling these resources, as is often done, the Isma`ili community is able to further improve the living conditions within their community.

The Isma`ili community has reduced their vulnerability to environmental hazards by diversifying the activities carried out by household members, while simultaneously reducing the pressure on the land base. Diversification is a key strategy for risk minimization within the subsistence economy (MacDonald, 1994) and can be extended to include commercial endeavours as well. Villagers still grow crops to meet their subsistence needs but supplement these activities with the growing and sale of commercial crops and with cash earnings from off-farm employment. Income generated from these activities is reinvested to improve the household's livelihood and to improve the skills of household members. Of course, increased involvement with markets and the cash economy means that Isma`ili households are more vulnerable to other hazards such as fluctuating market prices for crops and uncertain employment opportunities. However, the households' diversified skills and their social ties within the community generally ensure recovery from damaging events.

The Shi`i community, on the other hand, is still highly dependent on agriculture for subsistence. They have not diversified their livelihood strategy in the same manner as Isma`ili households and lack social and kin ties outside the village. Education, particularly of girls, remains a secondary concern to completing the productive tasks required for the subsistence economy. Few households are earning significant off-farm income or selling sufficient crops to enhance household wealth. As a result, hazard events that damage subsistence crops can be particularly devastating for Shi'i households. Thus, the vulnerability of the community has increased in a relative sense as a consequence of their dependence on subsistence crops in a context that has modernized around them.

5.4.3 Household vulnerability

At the household level, vulnerability is related, in part, to the amount of resources that a household can access (Blaikie *et al.*, 1994; Enarson and Morrow, 1998). This mainly concerns the resources held directly by the household such as its labour resources and those that can be accessed due to social ties inside and outside the community. Prior to the increased rate of external interactions, power and wealth within the village related to the amount of land and livestock owned by a household. In addition, several factors played a role including lineage, respect within the religious community and association with other people in power (which also often related to ownership of land and property). The incorporation of modernization processes has added new elements to these still important criteria. Socio-economic position is now also based on factors such as ownership of agricultural equipment, vehicles and shops, level of education and income. These new criteria have changed the balance of wealth and power in Nomal and have generally widened the gap between the 'wealthy' and the 'poor'. This often means that the affluence of wealthy households has increased, while the condition of poor households has worsened. When damaging events occur, it is those households with access to greater and more diverse resources, and with strong social ties within the community, that tend to be least affected.

This should not undervalue the importance of land as a means of improving the livelihoods of villagers, and as a contributing factor to the widening gap between wealthy and poor households within the village. It is often the income generated by the commercial sale of crops that enables households to educate children and earn off-farm incomes. This, in turn, diversifies the resources accessible to them and improves their

overall resilience to damaging events. However, many households have an insufficient land base to grow commercial crops, as all their land is needed for subsistence practices. These households are unable to benefit from access to diversified resources.

Those households with greater land resources and diversified sources of income are generally less reliant on the productivity of their lands for their livelihood on an annual basis. That is, they can afford to lose some land without being significantly affected. Conversely, those with limited land resources and few sources of income are more susceptible to damaging events as their livelihood is more intimately connected to the productivity of their land on an annual basis. This pattern was evident during the 1960 glacial-lake outburst flood when floodwaters eroded a one kilometre wide tract of land bordering the Hunza River. Households with large landholdings, who lost some land along the river, were not greatly affected. They had many other plots of land scattered about the village that were unaffected. However, those with small landholdings lost a greater proportion of their overall land base. As a result, their livelihoods were greatly affected and they perceived the hazard event as more significant.

5.4.1. Intra-household vulnerability

Differences in vulnerability do not cease at the household level. The social organization of the household, which is based, in part, on patriarchal structure, Islamic beliefs and cultural tradition, produce differences in power and access to resources among various household members (Agarwal, 1988; Hewitt, F., 1989; Herbers, 1997; Enarson and Morrow, 1998; Azhar-Hewitt, 1998; Azhar-Hewitt, 1999; Halvorson, 2000). These differences, in turn, produce varying degrees of vulnerability within the household. Generally, the largest differences in power result from gender, although age and position

in the family also play a part. Men or, more specifically, male heads of households, have the greatest control over household matters including the division of labour, the distribution of household resources and all decisions related to household and village matters. Women and girls are, in a sense, temporary residents of their husband or father's household and, as a result, have less control over household and village matters.

Table 5.1: The division of labour in Nomal (based on personal observation and Hewitt, F., 1989).

Men's work	Women's work
Ploughing the fields	Collecting water
Planting crop seed	Cooking
Irrigating fields	Cleaning
Threshing wheat	Washing clothes
Caring for livestock in the high pastures	Sewing
Collecting wood	Caring for children and the elderly
Off-farm employment	Milking the animals
Soldier	Weeding cropland
School Teacher	Cutting crops
Religious Scholar	Cutting grass for fodder
Professor	Collecting wood
Information technologist (computers)	Poultry farming
Engineer	Care of livestock in the village
Local politician	Vegetable gardening
	Collecting and drying fruit
	Off-farm employment
	School teacher
	Lady Health Visitor

There is a marked division of labour in the community of Nomal. This division is mainly between livestock herding (men's work) and agriculture (men's work in prestigious instances and women's work in instances of domestic crop cultivation and vegetable gardens) but applies to most other tasks of village life such as caring for children and maintaining irrigation channels (Hewitt, F., 1989; See Table 5.1, Plates 5.12, and 5.13). Women's workloads are particularly heavy in the summer months when they

are responsible for the majority of time-consuming tasks related to the agricultural economy. These tasks are in addition to the domestic tasks they perform year-round.

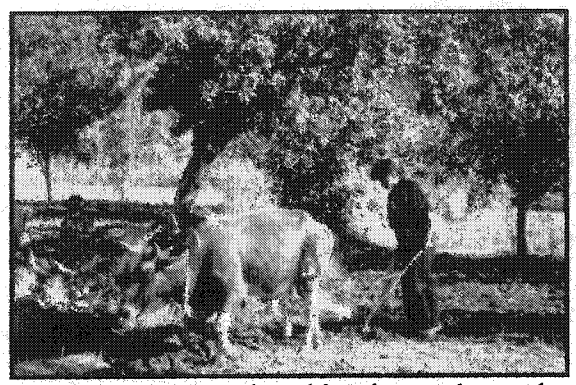


Plate 5.12 (left): Ploughing is men's work; a young man ploughs a field the traditional way in non-traditional dress.
Plate 5.13 (right): Pulling weeds and cutting grass for fodder is women's work.

The domestic responsibilities of women make them particularly vulnerable to rapid onset hazards such as debris flows (Enarson and Morrow, 1998). Women are likely to be in the home or fields when these events occur. In addition to themselves, they are responsible for young and elderly dependents, sick household members and livestock. There is often little time between the initial warning and the actual impact to get household members and livestock to safety. As a result, the personal safety of women is jeopardized. As was discussed earlier, a woman, her young son and her elderly mother-in-law died in the 1976 debris flow because they were unable to get out of the way in time. The woman was trying to free the livestock from their pens when the debris flow buried them under metres of debris.

Women's observance of 'purdah' can also increase their vulnerability. Purdah is a system of behavioural norms that seeks to reduce, or at least guide, the interactions between men and women (Herbers, 1997). Women usually wear loose-fitting clothes that do not show the profile of their bodies accompanied by a large piece of cloth, or chador,

to cover their hair, breasts and sometimes faces. Women avoid contact with men who do not belong to their household or kin group. When a meeting is inevitable, women avoid eye contact and cover their faces with their chador (Herbers, 1997).

Purdah is practiced to varying degrees in the village. It is observed to a greater degree within the more orthodox Shi`i community than it is in the Isma`ili community owing to differences in their religious faiths. The Shi`i community believes in the strict seclusion of women. Consequently, women of this sect are rarely seen outside the compound walls of their households and girls often do not receive a formal education. Isma`ili women observe a much more relaxed form of purdah. They are free to move about the village to carry out their agricultural duties and are often seen in the fields some distance from their homes. In some instances, they need not even cover their heads. In addition, young girls frequently receive a formal education.

Age and marital status also affect the degree of purdah observed by women and girls (Hewitt, F., 1989; Herbers, 1997). Shi`i girls begin wearing chadors at a very young age while Isma`ili girls begin around the age of twelve. However, the greatest restrictions are placed on unmarried women of marrying age, and newly married women of childbearing age. These restrictions prevent any contact between men and women that could dishonour male relatives. As women age, the restrictions placed on their conduct and movements begin to lessen. Elderly women are often able to move freely about the village without the accompaniment of a male escort.

As a result of observing purdah, women of both sects are largely confined to the household compound and only leave to perform specific agricultural activities. Even then, a male household member usually accompanies them. These practices result in a

division of space within the village (Hewitt, F., 1989; Herbers, 1997). The household, its walled enclosure, gardens and narrow walkways that weave through village lands are a female-dominated space. It is within these areas that women perform their productive tasks while, at the same time, being kept separate from unrelated men. Main roads, bazaars and places outside the village proper (i.e., high pastures and Gilgit) are male-dominated spaces where women are rarely seen and should not go alone.

The limitations placed on the mobility of women, as well as the division of space within the village, considerably increases women's vulnerability by restricting their access to public space (Hewitt, F., 1989; Herbers, 1997). It is within this space that village meetings take place, development initiatives are introduced and decisions regarding village life are made. Women are unable to take part in the decision-making process, except by influencing the male members of her family within the confines of the household. As will be discussed in more detail later, modernization processes that widen the public, male-dominated domain and contract the private, female-dominated domain exacerbate this situation (Hewitt, 1997a).

The vulnerability of women also stems from their lack of control over productive resources such as privately owned agricultural land and livestock (Agarwal, 1988). These resources are usually passed down from father to son(s), reinforcing the dominant control of men over resources. Women do not usually inherit land as they receive considerable pressure to cede their rights to their father's land to their brothers. This is done because women become members of different households when they marry and household landholdings are too small to support repeated land divisions.

Whereas men stay in their household of birth for their entire lives, women marry and move to their husband's household (i.e., patri-local marriage). Thus, in a sense, they are 'temporary' residents in their households of birth and spend the majority of their lives living in their husband's household. This 'temporary' status can affect the investment placed into girls by their paternal household. Whereas investing in boys through education will ultimately benefit the entire household, investing in girls does not have this same benefit. Few village women over the age of 20 have received a formal education and many are only able to speak the community language. Even in the contemporary context where many educational opportunities exist, many girls (particularly Shi`i girls) are not formally educated as they are more useful to the household if they are helping with productive tasks. The lack of formal education girls receive and the restrictions placed on their mobility mean that there are few opportunities for women to gain off-farm skills. As a result, women generally have less control over income-earning opportunities and cash within their own households.

The lack of access to and control over productive resources and income-generating opportunities that most women experience in the village makes the conditions of everyday life difficult. These inequalities are often reproduced and aggravated during periods of stress and following damaging events.

5.5 Traditional Social Responses to Hazard Events

It is not surprising that human beings persist and even prosper in areas susceptible to recurrent damaging events given that the ideal places for human settlement often coincide with potentially damaging processes (Kates, 1980). In the case of Nomal, this

location is a sediment fan and river terraces that provide accessible, relatively flat land suited to cultivation and a source of water for irrigation purposes. Nomal has experienced several damaging events over the past 40 years. These events vary greatly in origin, in who is affected, and in the responses that have been undertaken to reduce damage. As discussed earlier, vulnerability is clearly related to social organization within the community. Social responses to damaging events also have a socio-economic component and responses vary depending on the adjustments perceived to be available to individual households or household members (White, 1964). Several of the widespread cultural adaptations visible in the community have presumably evolved as a result of indigenous knowledge gained through direct interaction of residents with their environment (White, 1974; Berkes and Folke, 1998). Generally these adaptations reduce vulnerability by spreading productive activities over horizontal and vertical space (Hewitt, K., 1989; MacDonald, 1998).

Perhaps the most pervasive cultural adaptation to environmental variability and uncertainty throughout Nomal and the Northern Areas has been the system of land division. Household landholdings generally consist of several small plots scattered throughout the village. This system has its roots in the historical settlement of the area and the necessities of irrigation agriculture (MacDonald, 1998). Plots of land were opened up along irrigation networks during the initial period of settlement. To ensure all households had land in production, small plots were the norm. As the settlement grew, irrigation networks expanded producing the patchwork of fields currently visible in the village. For the most part, the system remains intact, presumably because it is both materially beneficial and culturally relevant to villagers. However, some changes in land

distribution have occurred as a result of wealthy households purchasing or bartering for land from poorer households.

Having small plots of land scattered about the village opposes conventional thinking related to efficient agricultural practices such as maximum yield per inputs (Pilardeaux, 1997). Villagers realize that large tracts of land require less agricultural inputs and are less labour-intensive (Pilardeaux, 1997). However, by having small plots scattered throughout the village, farmers make use of micro-niches favorable to particular crops (through aspect, shading, micro-climate, etc.) and reduce their vulnerability to any one damaging event (Butz, 1994).

This diversification of landholdings and agricultural activities has a vertical component as well. Nomal's lands are not confined to the village proper but, instead, occupy favourable niches for thousands of metres in elevation above the village. Farmers exploit large elevational ranges and altitudinal gradients that produce gradients in moisture and temperature conditions (Hewitt, K., 1989). The ecological niches that result allow residents to optimize their activities and use different spaces throughout the year. High pastures allow grazing from April through October. Grazing lands reduce the amount of cropland required for fodder cultivation and the pressure of grazing animals on the village ecosystem. Their migration to the high pasture ensures that a damaging event will not affect the whole of the livelihood system during these months. The production of fodder outside the village proper is another activity that exploits altitudinal gradients. Its production outside the village allows prime agricultural land within the village to be used for domestic and commercial food crops. This further reduces the pressure on the main village as the sole site of production.

A purposeful land use pattern is also evident in the village resulting from an intimate knowledge of past damaging events. Essential infrastructure and buildings are built in the most stable areas. The road passes through the centre of the village; the bazaar, post office, health centre and schools are located in close proximity. The most valuable crops are sown on the 'safest' and generally oldest plots, as these plots have the most developed soil. However, this is a relative measure depending on a particular household's landholdings. The more marginal lands to the west of the village, which have been repeatedly affected by debris flows, have not been put into cultivation. A buffer area made up of less valuable crops, such as fodder and buckwheat, and more stress-resistant fruit trees, has been informally established between this western fringe and the main areas of agricultural production.

Responses immediately following damaging events require community cooperation and action. The government and other outside agencies generally have no involvement in the immediate period following a damaging event. Social ties within the community are relied upon to ensure livelihood systems are rebuilt quickly. This is reinforced, in part, by the existence of common property resources (Folke and Berkes, 1998). High pastures, irrigation channels, mosques and schools are just some examples of common property resources held by the community. Several households affected by damaging events have relied on members of the community to recover the bodies of the dead, rebuild homes, redig irrigation channels, provide seeds and replant fields.

Villagers often reclaim lands affected by hazard events. Reasons for reclaiming land are varied. Some community members have no choice but to replant in the same area due to limited landholdings. These are the households that are most vulnerable to

damaging events and generally fall into a cyclic pattern of damage and reclamation. Others reclaim land to grow less valuable crops such as fodder or buckwheat. Still others have stated that they reclaimed land because they felt ashamed that other community members were reclaiming theirs. The latter reason emphasizes the importance of social norms in dictating individual behavior. Land reclamation may also have a material dimension as lands not in production affect the functioning and maintenance of the irrigation network.

Those villagers who have been affected by damaging events usually stay in the village despite their losses, even if they own land in other villages. Residents usually state simply that this is their home and they cannot start over elsewhere; personal identity is closely linked to the place one is born. Others have made a significant investment in their lands as is witnessed by one man who sold 6 acres of land in Karimabad to buy 1-1/4 acres in Nomal.

In summary, social responses to damaging events in Nomal are characterized by a high absorptive capacity and a large number of adjustments widely shared among individuals and the community as a whole (cf. Torry, 1978; Kates, 1980). Responses often involve modifications in behaviour or agricultural practices to harmonize with their environment. Adjustments are flexible, closely related to social organization and supported by norms of behaviour within the village. Social responses require cooperative action by the community, usually without the aid of outside assistance. Relocation outside the village rarely results from damaging events as most farmers do not have the means to change their location or livelihood system and individual identity is closely tied to one's place of birth.

5.6 Modernization and Vulnerability

Once isolated from the administrative and commercial capital of the Northern Areas by the steep Hunza River valley, Nomal's economy was characterized by subsistence agro-pastoral and barter activities as recently as 30 years ago (Shah Makeen, 2000, pers. comm.). Since this time, the community has undergone rapid development both through their own initiatives and through the initiatives of the Aga Khan Rural Support Programme (AKRSP). The introduction and incorporation of modernization processes into village life has produced both positive and negative outcomes. Overall, modernization processes have generally decreased the ability of already vulnerable groups (particularly women and some Shi`i households) to cope and respond to damaging events, while the resources available to already powerful community members (particularly male heads of households and affluent households) have increased.

The transition began in the 1950s with the building of a dirt road by blasting along the steep valley slopes of the Hunza River. This road joined the small community to the bazaars of Gilgit and established a market to sell the surplus agricultural goods being produced in the area. Initially, this "road" was primarily used as an easily negotiated footpath. Today, several jeeps make the daily three-quarters of an hour journey to and from Gilgit. The villagers of Nomal have, for some time, wanted this road paved and have even resorted to burning down the government resthouse in the early 1990s to reach this end. Although the government has been promising to pave the road for many years, the process had just begun during my visit in 2000. By increasing the accessibility between the two centers, it can be expected that social and economic interactions will be facilitated.

In 1980, electricity was introduced to the area. A small hydroelectric plant established on the Naltar River provides Nomal with 70 kW of energy. The hydro scheme is unable to support the energy needs of the entire community, so the community alternates days with and without power. Often times, however, the electricity still fails to come on days when it is expected. A joint project between China and Pakistan will result in a new 18 MW hydroelectric plant being built in the near future. This plant will service the majority of the Naltar valley and provide the village of Nomal with a consistent supply of electricity.

The introduction of electricity has resulted in several changes within the village. Firstly, the availability of light has extended the hours over which community members can perform productive tasks. Prior to electrification, village activities corresponded mainly to the rising and setting of the sun. Electricity allows villagers to continue their work beyond daylight hours. In addition, the introduction of electricity has helped to reduce the workload of women in those households that can afford to buy such luxury items. Small machinery, such as ghee churners, may be used to speed up tasks usually done by hand. Some households have also purchased electric radios and televisions. Access to Pakistani and Indian stations may have a significant effect on the village by bringing national news coverage, propaganda and outside influences into the community.

Villagers credit the Aga Khan Rural Development Programme (AKRSP), a privately owned non-profit organization, as the primary facilitator of development in the community. The Field Management Unit of AKRSP, located in Gilgit, services the Nomal area and the organization has been working in the village since 1982. Several

programmes concerning agriculture, livestock, forestry, credit, and social organization have been initiated and implemented since this time (See Table 5.2).

The mandate of the organization is to facilitate income generation and improve the quality of rural farmers' lives in Northern Pakistan (AKRSP, 1995). The organization sees itself as a catalyst to rural development. In their view, development is facilitated through the organization of local people, the pooling of monetary resources and the establishment of local structures to sustain the development process. Once these structures are in place, the organization withdraws from the community and local residents take over the process (AKRSP, 1995).

The aim of the projects implemented in the village to date is to improve the livelihoods of local farmers and increase their income generation. However, some of the means used by AKRSP to achieve this aim are inconsistent with local forms of social organization. Several village organizations (VOs) and women's organizations (WOs) have been established with minimal input from the local community and with little regard for existing and long-standing forms of local governance and social organization. As a result, the interests of VOs/WOs and the interests of local leaders are sometimes in conflict. The erosion of local forms of social organization is particularly problematic in the context of vulnerability, as local systems have proven to be well-adapted to the range of hazards affecting village lands.

Table 5.2: Summary of Aga Khan Rural Support Programme (AKRSP) initiatives by sector in the community of Nomal (Shah Makeen, 2000, pers. comm.).

Sector	Description of Projects to date
Agriculture	• improving seed quality of crops (wheat, maize, and fodder); • introducing small machinery for women, such as apricot oil expressers and ghee churners, to reduce their workload and enable them to earn some income; • training women to improve their kitchen gardens; • nursery management for trial and demonstration crops; • introducing new or improved varieties of fruit trees, such as cherry trees for commercial sale.
Livestock	• initial projects focused on preventing the loss of livestock through disease and mismanagement (i.e., providing medication and vaccinations for livestock and education for their management); • more recent projects focus on feed and breed improvement designed to enhance the quality and quantity of animals in the area.
Forestry	• establishing tree plantations on barren land to meet the local demand for fuel, fodder and timber; • training local people to be forestry specialists to oversee the project • forestry only for local use, not commercial sale.
Credit	• provides individual and group loans at interest rates of 22 and 15 percent per annum respectively. • Rs 30 million in loans is available for the Gilgit region alone. • the credit program allows for group projects such as irrigation channels, as well as private projects such as commercial shops. • group loans require collateral to prevent against defaulting from the loan. This money is put into a high interest savings account.
Social Organization	• establishment of Village Organisations (VOs) to promote community development through cooperative endeavour, accumulation of capital, upgrading managerial skills, and identifying local activists for development work; • later establishment of Women's organizations (WOs) in the area by their own initiative.
Natural Hazards	• protective spur projects for areas vulnerable to erosion and flooding; • rotational grazing; • reforestation projects to improve slope stability.

Another method employed by the development agency that is somewhat inconsistent with the local system is credit. Most of the development initiatives that have occurred in the village are a result of group or individual loans secured through the community's pooled resources. While these loans do allow projects to be implemented that would probably not be otherwise, they introduce financial responsibilities and consequences beyond the understanding and resources of local farmers.

The role of the government in development has been minimal and the general belief among villagers is that the government simply does not care. This attitude stems from several incidents within the community. The government has been promising for 15 years to pave the road from Gilgit to Nomal, a process that did not begin until the summer of 2000. In addition, the villagers have asked the government to fund an irrigation project for the drought-prone area to the west that, to this date, has been unanswered.

5.6.1. Changes within the agricultural system

The impetus behind change in the agricultural system has been the desire for increased crop yields. However, the necessity for this change has largely resulted from the seasonal shortage of labour within the community (Pilardeaux, 1997). Villagers perceive many benefits from increased agricultural productivity. These include feeding the growing population, producing more crops for the commercial market and increasing household income.

The introduction of the cash economy and off-farm employment has brought about new opportunities, responsibilities and expectations, particularly for men. Incomes are used to supplement the sale of agricultural surplus or specialized commercial products

at the market. Most women remain in more traditional roles but are affected by the changes just the same. Many have a growing responsibility for the traditional subsistence economy, especially agricultural and domestic matters, as husbands look for paid work in Gilgit, downcountry or overseas. The out-migration of men has led to a seasonal shortage of labour available to perform traditionally male agricultural roles. The solution to this problem has been the increased mechanization of the agricultural system, which reduces the amount of labour required to perform these roles.

The mechanization of agriculture within the village began in the early 1990s, with traditional methods of ploughing and threshing yielding, in part, to farm machinery. The threshing of wheat, which traditionally involved employing harnessed animals in a process extending over several days, is now accomplished in less than an hour. The implementation of the tractor and plough similarly saves on labour.

The improvement of the road and the strengthening of the cash economy have allowed farm equipment to be rented from Gilgit for the past 8 years. The rental of tractors, ploughs and threshers requires community cooperation by pooling monetary resources and designing a schedule of use for all community members. Tractors are usually continually in use at harvest time to ensure crops are not spoilt. If the machines fail to arrive, it is imperative that farmers promptly revert to traditional methods to avoid post-harvest losses due to unfavorable environmental conditions (Pilardeaux, 1997).

Despite these initiatives, agricultural mechanization has not produced considerable gains in crop yields, as farmers implement farm machinery mainly in an attempt to counterbalance the seasonal shortage of labour. Furthermore, it has not led to

an expansion of irrigated lands within the village. On the contrary, many villagers are taking low-yielding and inaccessible fields out of production.

The introduction of chemical fertilizers also reflects the changing circumstances of the rural economy in Nomal. Whereas animal and human waste products were traditionally used to fertilize fields, several recent changes have necessitated the use of chemical fertilizers. Declines in productivity are resulting from lower labour input in agriculture due to increased out-migration by men, decreasing numbers of livestock and a corresponding decrease in farm manure, the introduction of so-called 'flush' toilets rendering use of human waste obsolete and the discontinuation of soil conservation practices such as leaving land fallow (Whiteman, 1985; Pilardeaux, 1997). The need for chemical fertilizers is also increased due to the abandonment of low-yielding and relatively inaccessible fields, and the growing trend towards cash cropping in the community.

The use of fertilizers has been problematic for several reasons. Increased crop yields depend on regular agricultural inputs. Furthermore, correct application of fertilizers requires proper handling, exact timing, a strategy balancing fertilizer and irrigation and timely substitution with improved seed (Pilardeaux, 1997). These conditions are rarely met by Nomal farmers owing to the irregular and inadequate supply of chemical fertilizers and the inconsistent supply of seed in the Northern Areas as a whole (Pilardeaux, 1997).

Fertilizers and pesticides have predominately been used on local vegetable gardens. Kitchen gardening, as it is called, is 'women's work' and thus, the introduction of fertilizers and pesticides have particular consequences for women (F. Azhar-Hewitt,

2002, pers. comm.). On the one hand, their introduction eases the workload of women by reducing the amount of weeding required. However, the application of fertilizer is also women's work and is generally done without facemasks or gloves. Consequently, chemical fertilizers pose a significant health hazard specifically for women. The application of fertilizers and pesticides has wider implications on health and safety in the community. Chemicals can easily enter the unmonitored and untreated water supply that serves as the primary source of potable water in the community. Residents appear to be unaware of the negative impacts of their use.

5.6.2. Changes to the social system

The presence of development agencies and the accumulation of cash among village residents have allowed additional schools to be built in the community. Two of the community's three schools have been built entirely from funds collected within the community with the organizational assistance of the Aga Khan Foundation. This includes buying the land and building supplies necessary for such institutions. In addition, community members pay school fees in the amount of Rs 200 per child per month (approximately $4 U.S. at the time of reporting).

Education is "available" to all village children, both boys and girls. However, the decision as to whether children attend school is left to the discretion and resources of the household head. One obvious incentive for formally educating children is the potential for off-farm income in future years. Generally, Isma`ili families educate both boys and girls while Shi`i families are more apt to educate only boys due to their strict observation of purdah and poorer economic position. However, those with limited incomes within both communities are left in the unenviable position of 'choosing' whom to send to

school. The number of children attending school has increased dramatically, particularly the number of girls, and therefore contributes to the shortage in farm labour within the community. In recent years, educational opportunities have opened up to include English-medium schools in addition to the traditional Urdu-medium schools (Urdu is the national language of Pakistan). English-medium schools are particularly suited to a future of non-farm employment.

An Aga Khan Health Centre (AKHC) was established in Nomal Centre in December of 1998 servicing seven villages between Nomal and Bala Naltar—1000 households and 12,600 people in total. Four women run the center; two are Lady Health Visitors (LHVs). General health in the community is improving as a result of pre-natal care, vaccinations, and most importantly, health education. The AKHC holds free community meetings on family planning, the importance of child immunizations, women's health, hygiene and family-based water treatment. A recent survey carried out by the Health Centre in the village of Sadrudinabad showed that the majority of residents were utilizing professional treatment sources when ill, seeking antenatal care, and receiving immunizations. However, only about half of respondents were using family planning strategies and very few were using water treatment techniques (See Appendix C).

Modernization and the cash economy have brought about changes to the general health of the community. Prior to the introduction of the cash economy, villagers produced a surplus of food but had no market in which to sell it. Households were able to eat all the food and as a result were very well nourished. Traditional dietary staples, such as apricot tea and butter, are now being sold commercially in the bazaars of Gilgit for a

profit and imported tealeaves and oils are being used as their replacements. These changes in diet, coupled with a more sedentary lifestyle, have lead to health concerns such as obesity, high blood pressure and heart disease that were unknown in past years.

5.7 Concluding Remarks

Fluctuations in natural systems become hazardous only when they intersect the lives and livelihoods of vulnerable people (Hewitt, 1997a). Over the past century, local residents have shown a considerable capacity to absorb losses from, and cope with, damaging events. However, not all community members and households fare the same within the village. Certain groups and individuals are more vulnerable due to their lower socio-economic status and their lack of access to resources within and outside the community. At the village scale, members of the Isma`ili community have diversified their access to resources by maintaining local subsistence agro-pastoral activities, while simultaneously incorporating income-generating activities. Income earned from these activities is usually reinvested to improve conditions within the household or the Isma`ili community. The vulnerability of the Shi`i community to damaging events has increased in a relative sense. Most households continue to rely predominantly on agro-pastoral activities for their livelihoods. Few have incorporated income-generating activities or invested in improving local conditions.

At the household level, socio-economic status is one of the main factors affecting vulnerability. Access to productive resources, diversified livelihood strategies and strong social ties with local community members reduce vulnerability and ensure recovery from damaging events. Those households without these characteristics have few resources to

draw upon in the event of a subsistence crisis. Furthermore, they are often unable to take part in development initiatives due to their lack of financial resources.

Within the household, social organization affects the vulnerability of household members. Specifically, the gendered division of labour, space and influence within the community increases women's vulnerability. Women are responsible for other household members, are in the village during the peak period of debris flow activity, are confined largely to private space and lack control over productive resources. Due to restrictions on their mobility, they are often left out of public forums concerning village development.

The building of the road connecting Nomal and Gilgit did not itself cause developments in the community but it offered the infrastructure to support and accelerate certain modernization processes. These processes include the extension of lowland administrative control into the mountains (Stellrecht, 1997), interaction with commercial markets and the implementation of community and AKRSP development initiatives; processes which have resulted in great changes in the life and conditions of work for the villagers.

Villagers attribute the majority of local development to AKRSP. The organization has placed community members into village and women's organizations where they can pool their resources. High-interest loans allow villagers to invest in local projects to improve the rural economy and social institutions within the community. However, the so-called 'benefits' of development have mainly eluded local women. Women remain, for the most part, in more traditional roles within the community. The seasonal shortage of labour, brought about by the out-migration of men seeking off-farm employment, has

increased their workload. These are issues that need to be addressed to reduce the vulnerability of women within the community.

Development has also had consequences for health within the community. The changes to traditional diets, coupled with more sedentary lifestyles, have introduced previously unheard of diseases, such as heart disease and cancer, to the village. The introduction of chemical fertilizers is also problematic, as potable water is taken directly from untreated irrigation channels.

The consequences of development, similar to damaging events, affect the community unequally and have generally served to increase the vulnerability and diminish the range of adjustments available to already vulnerable groups (Enarson and Morrow, 1998). This has been shown in relation to gender, as new technology for growing cash crops and the out-migration of men for employment has diminished women's already minimal control over resources, while at the same time increasing their workload. Also discussed was the unequal access of farmers to agricultural innovations and children to education. These examples illustrate that it is primarily those members of the community having plentiful resources who are able to adopt new techniques and skills, thereby improving their situation, while the situation of those already lacking resources worsens.

CHAPTER VI: DIFFERENTIAL VULNERABILITY TO DEBRIS FLOW HAZARD IN HALDI, DISTRICT GHANCHE

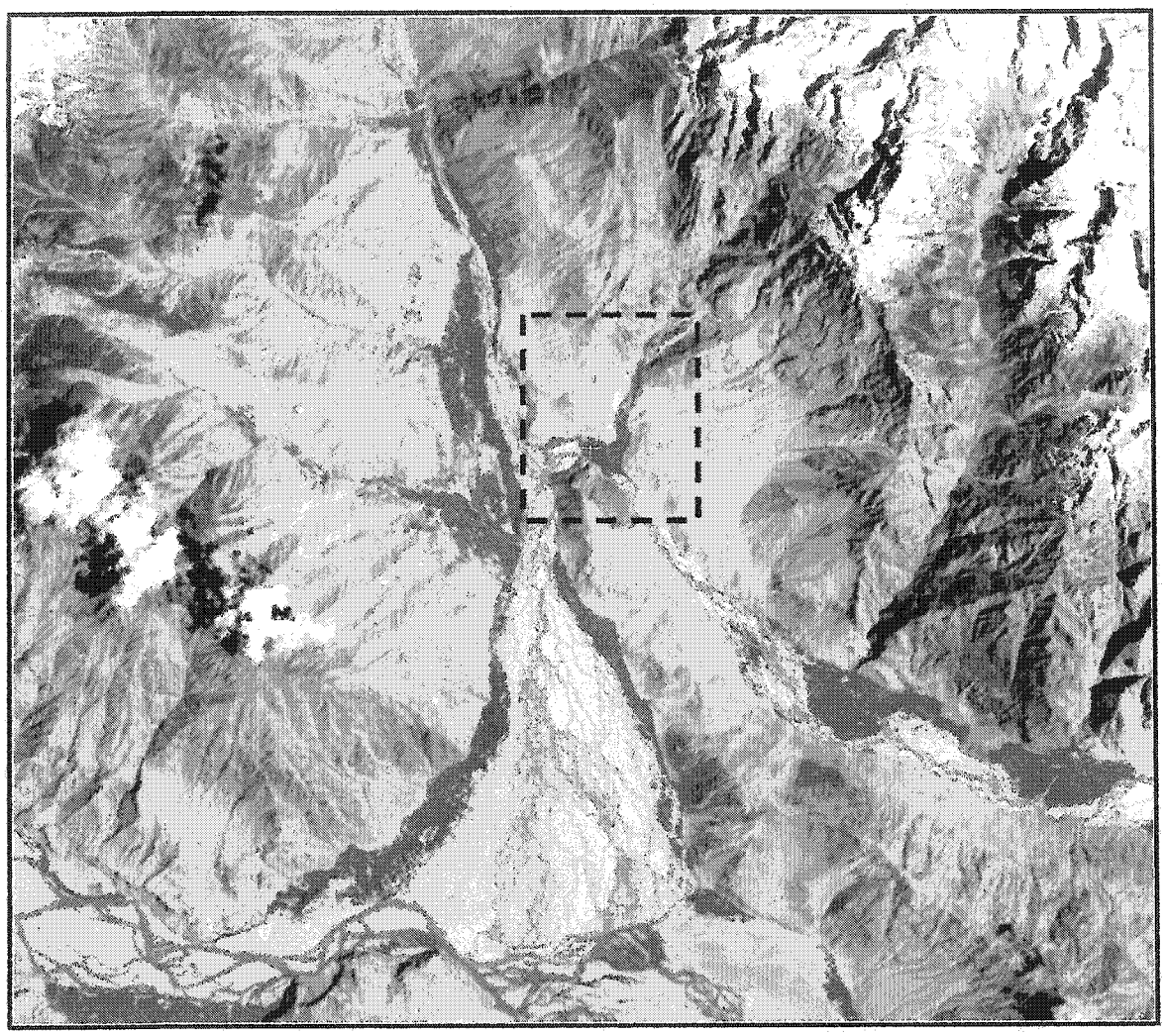


Figure 6.1: Landsat 7 ETM+ satellite imagery showing the village of Haldi at centre.

6.1 Introduction

As was evident in the previous chapter, vulnerability and social response to damaging events vary within communities. This chapter uses a case study approach to examine the mountain hazards affecting the small mountain village of Haldi, as well as the range of experiences of, and vulnerabilities to, these mountain hazards. The purpose is not to repeat what has already been discussed in the previous case study, although this certainly will happen on occasion. Instead, the aim is to look at how hazard experience, response and coping vary within and between villages in the Northern Areas. Haldi and Nomal differ greatly despite their common situation in this region. The villages have distinct histories and systems of socio-cultural organization and belong to different ethno-linguistic groups and religious sects. They are situated in separate administration areas and are exposed to varying rates of external influence and modernization.

The primary aim of this chapter is to reveal some of the underlying factors affecting vulnerability in the village of Haldi. A secondary aim, accomplished, in part, by the juxtaposition of the two case studies, is to illustrate how differences in location, history, socio-cultural organization and rates and extent of modernization produce differential vulnerabilities. The latter objective will be explored further in Chapter 7. In this manner, the contrasts between high mountain villages become evident.

6.2 Physical and Social Setting

Haldi is located at the confluence of the Hushe and Saltoro valleys at an elevation of 2704 masl. The village is situated in eastern Baltistan, only kilometres away from the cease-fire line with India, and falls within the jurisdiction of Ghanche District (See

Figures 6.1 and 6.2). Haldi's economy is primarily based on subsistence agro-pastoral activities. The production system utilizes a range of landscape features within several altitudinal zones. These include sediment fans, river terraces and terraced slopes near the valley floor (2700 masl) and, through vertical transhumance, high vegetated valleys for pastureland at elevations between 3000 and 4500 masl (See Plate 6.1). Despite the introduction of off-farm employment opportunities and the cash economy, agriculture and animal husbandry remain the primary occupations of most village households.

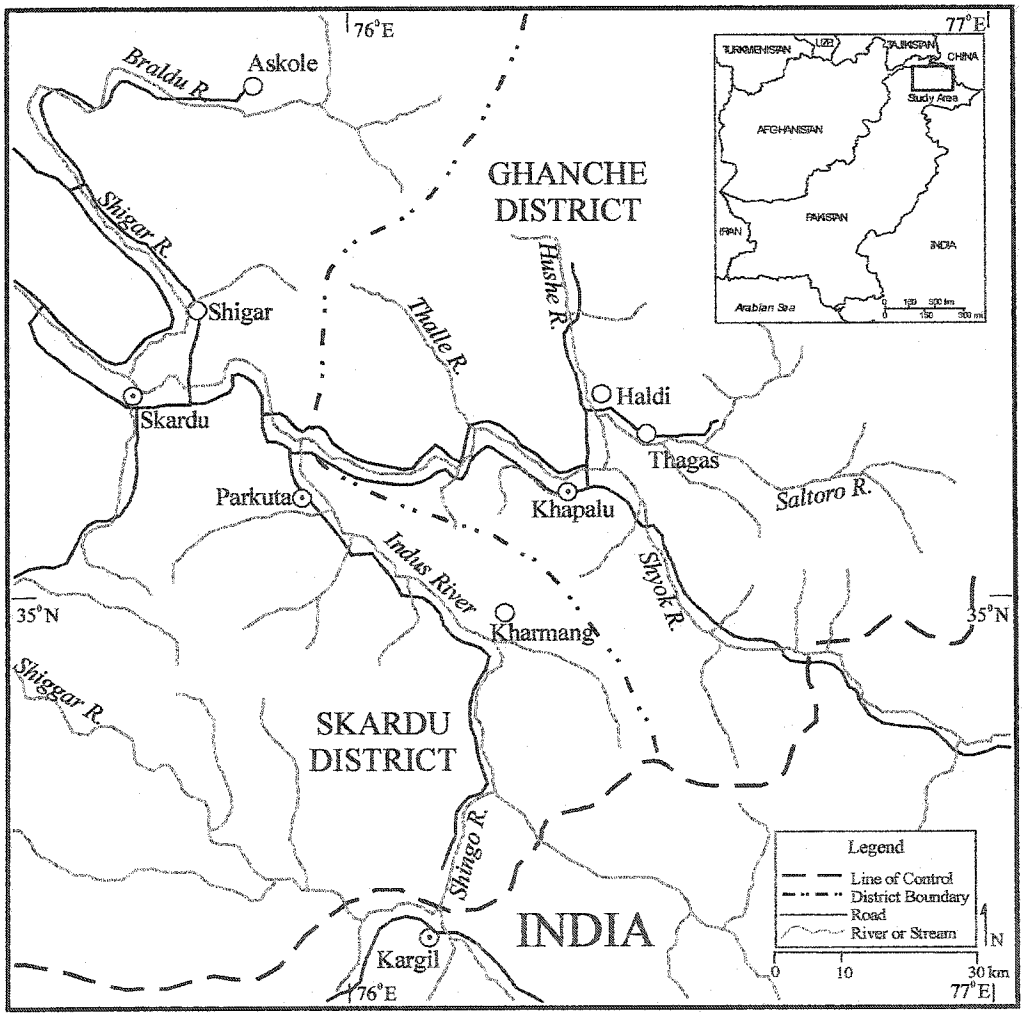


Figure 6.2: Map of Skardu and Ghanche Districts, Northern Areas, Pakistan. Haldi is located northeast of Khapalu at the confluence of the Hushe and Saltoro Rivers (adapted from Stellrecht and Bohle, 1998).

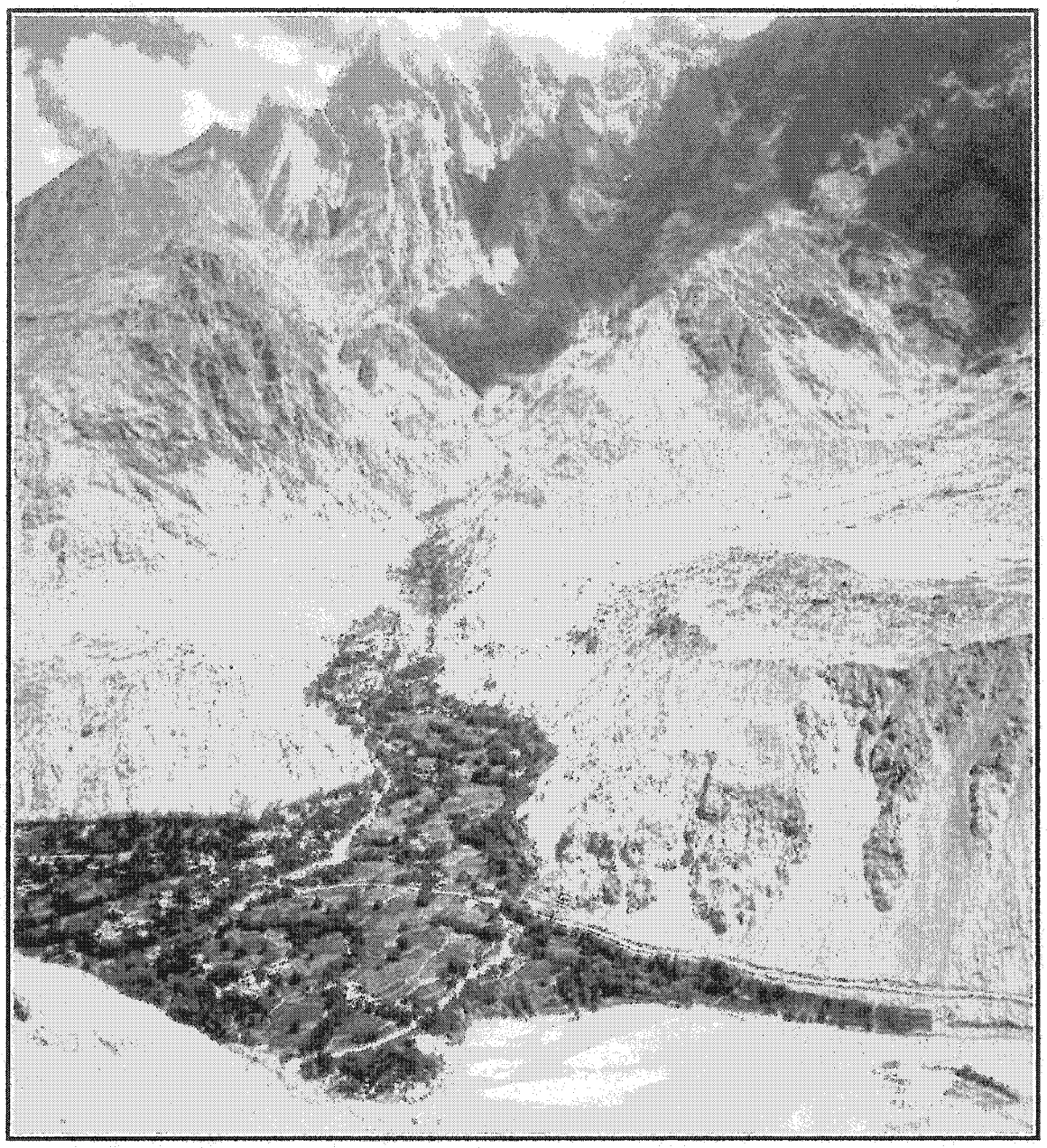


Plate 6.1: An oblique aerial photograph of Haldi taken from a ridge opposite the village.

Cropped land is privately held, usually in the name of the male head of the household whereas grazing land is held commonly as a village resource with equal access granted to all village households. Production, distribution, and consumption occur largely within the extended family group and there is little exchange of produce with regional markets.

Haldi lies in the single cropping zone and has a short growing season. The climate, like much of the Karakoram, is arid and the precipitation that occurs on the valley floor during the growing season alone is insufficient to support crop production. Instead, production depends on meltwater, from glacial ablation and snowmelt at higher altitudes, which reaches the village as stream runoff and is channelled into village fields (Kreutzmann, 1993). Haldi has an extensive network of irrigation channels that weave throughout village lands. A locally produced and regulated schedule dictates when households may irrigate their fields. As a result, irrigation takes place at all hours of the day and night so that little water is wasted. Performing this task and maintaining irrigation channels are time-consuming, yet essential, tasks performed by both men and women.

Crop cultivation in Haldi occurs on a polygenetic sediment fan (Derbyshire and Owen, 1990), river terraces and the floodplains of the Hushe and Saltoro rivers (See Figure 6.3). These lands support a crop base of wheat, buckwheat and barley. Crops of wheat and barley are rotated on an annual basis on each plot. The planting and harvesting of a quick-growing buckwheat variety usually follows the barley crop because of the latter's quick maturation. Women maintain vegetable gardens close to the household adding ladyfinger, cucumber, potato, and onion to the household food supply. Fruit trees are also important food sources providing mulberry, apple, apricot, apricot seeds and almond.

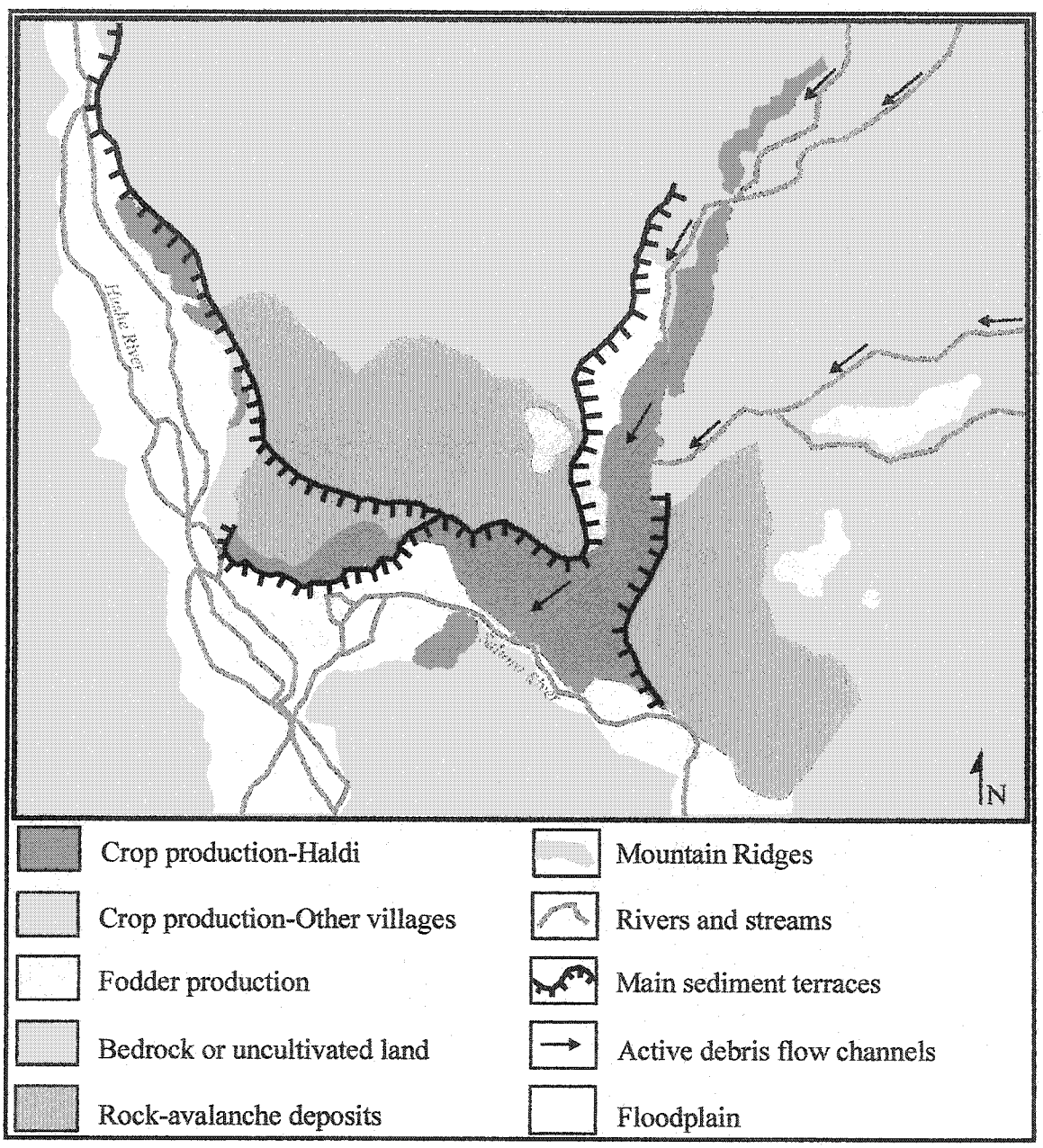


Figure 6.3: Sketch map of Haldi showing major landscape features and the location of productive lands (based on Landsat 7 ETM+ satellite imagery and field observations).

Fodder crops are grown outside the zone of permanent settlement on extensive plateaus to the northwest and northeast of the village due to limited lands within the village proper. The plateaus are situated on rock-avalanche deposits reworked by mass movement and lacustrine processes (Hewitt, 2002). These processes are responsible for

producing the extensive plateaus and the soils that make fodder production possible. However, fodder crops are difficult to maintain in these areas due to a lack of infrastructure for irrigation, a shortage of labour to maintain the minimal infrastructure currently in place and water deficiencies, particularly for non-primary production activities.

Crop production is supplemented by the rearing of livestock including chicken, sheep, goat, cattle, yak and dzo (a yak-cattle cross-breed). Livestock are kept primarily for their produce (dairy and wool) and draught power to plough fields. Meat is not a common part of the village diet and is only consumed on special occasions. Livestock are also used as a means of storing capital. In the event of crop failure, for whatever reason, livestock may be traded for produce or sold at a nearby market for cash to buy provisions.

Haldi has several high pastures, situated at varying elevations, which surround the village. Grazing lands are common property resources (meaning all community members have equal right to their use). The village's claim to these resources is founded upon long-standing customary usage (cf. Chakravarty-Kaul, 1998). Livestock are privately owned but livestock care is a communal task. Men from different kin groups alternate travelling to the high pastures to care for grazing animals during the summer months. Travelling to several pastures ensures that the abundant food supply available at these altitudes is grazed. The limited fodder produced during the growing season is used to stall-feed livestock during the long winter months.

Men are responsible for the majority of tasks associated with livestock care, although women play a small role. Women's duties include caring for young or sick animals and milking the animals that remain in the village. The high pastures are strictly

a male space. Women never travel to these locations, nor are they involved with shepherding or grazing. I was, however, permitted to travel to one high pasture during my stay in the village. This was probably due to my foreign status as well as the fact that I did not participate in the work.

The pasture, a precarious-looking slope of at least 30 degrees with a thin grass cover littered with the remnants of several rockfall events, was located at an altitude of 4150 masl (See Plate 6.2). One steep slope was home to several small pens where sheep and goats are housed during the evening. The structures were made from large, tilted rocks enclosed by rock fences. This same slope was also the site of a small house made of stone where village men who come to care for the livestock reside (See Plate 6.3). Despite the high altitude, I was told there was another village pasture at a still higher elevation.

Plate 6.2 (left): Sheep graze on a precipitous slope.
Plate 6.3 (right): The high pastures are a male space where men from different kin groups alternate caring for village livestock; note the shelter made from rocks denoted by the red door.

Common lands are an important resource held by the village, especially for those households with small landholdings and few resources. However, in recent years, the village has been in dispute with surrounding villages regarding claims to traditional

common lands including high pastures and fodder areas. As a result, several areas have been left out of production. This has put considerable pressure on the village's already-strapped resources. Common lands are essential to maintaining the mixed farming economy and any concession of these lands would hinder the village's ability to maintain its current herds.

During winter months, the weather turns cold and snow blankets the village. Local residents do not own adequate clothing to spend much time outdoors. As a result, village life is centred on the household hearth. The division of labour does not cease during the long months of cold weather that can last from September through late March. Women often gather together in their homes to do handicrafts and to grind their crops. Men make mats and rugs from dzo and goat's hair, and sheep's wool. The months of living primarily in their homes are often described as long and boring by villagers—they look forward to the summer months when the weather is warm and they are busy doing productive tasks. However, several women also spoke of this time as a welcome rest from the heavy workload they maintain during the summer months.

6.3 Hazard History

Haldi has a long history of exposure to various mountain hazards including debris flow events, flooding and moisture deficiencies. This section details the hazards affecting the village and their characteristics.

6.3.1 Debris flow events

The biophysical landscape presents both opportunities and challenges for the villagers of Haldi. The agro-pastoral economy on which the village relies would be

impossible without the range of processes that have shaped the local landscape. These include frequent mass movements, flooding along powerful rivers and a massive rock-avalanche event.

The mounds of debris that surround the village are a small, scattered remnant of those materials originally emplaced by a prehistoric and catastrophic rock-avalanche that blocked both the Hushe and Saltoro river valleys (Hewitt, 2002). Mass movement, fluvial and lacustrine processes have repeatedly reworked the original deposit—much of it has been eroded, re-deposited or carried away by the Hushe and Saltoro rivers. The reworking and remobilization of rock-avalanche deposits by mass movement and flooding events is responsible for producing the polygenetic sediment fan and river terraces on which the majority of present-day settlement is situated (Derbyshire and Owen, 1990; Hewitt, 2002). These processes are also responsible for breaking down parent materials into soils useable for agriculture.

The processes that produced the sediment fan were most likely of a higher frequency and magnitude than the events of the recent period due to paraglacial unloading of oversteepened slopes following deglaciation (Owen, 1991; Iturrizaga, 1999). These processes certainly continue today, albeit on a much smaller scale. Nevertheless, they present a challenge to village life.

Local landscape features including the sediment fan and river terraces allow permanent settlement in this area (Hewitt, 1984). However, the processes responsible for these features pose a significant hazard to the community. The rock-avalanche deposits provide a ready supply of sediment for the frequent, sometimes disastrous, debris flow events the village experiences. These events are usually triggered by heavy rains (which

may be combined with snowmelt at higher altitudes) in summer months (Derbyshire and Owen, 1990). The high velocity of flow, coupled with the volume and composition of water and debris, pose a considerable threat to the lives and livelihoods of Haldi's inhabitants. Many villagers have lost family members, homes, livestock and crops to these events (See Appendix E).

An often-discussed event within the village occurred in the late 1970s along the main river channel that runs the length of the village. This was the highest magnitude event experienced by the village in recent history and affected approximately one-sixth of village lands. Heavy rains mobilized the unstable and uncemented rock-avalanche deposits above the village bringing a rapid surge of 'black water' through the centre of the village. The four neighbourhoods of Rahimpekor, Tarhahnpekor, Asurepekor, and Usoupekor, which are located in the narrow corridor between the rock-avalanche deposits, were completely inundated with a thick blanket of mud (See Figure 6.4). All eight houses situated in the area were destroyed and buried by the force and volume of debris (See Plates 6.4 and 6.6). Many households also experienced significant crop and livestock losses. The entire channel (and particularly the uppermost reach) is littered with rock debris. Some of the boulders transported by the debris flow are the size of houses (See Plate 6.5).

The areas hardest hit by this debris flow correspond with the reaches where the channel has a poorly-developed cross-section, allowing the channel walls to be overtopped by the volume of water and debris (See Appendix D, cross-sectional profiles one (downstream) through five (upstream)). Transects three and four correspond with the area most affected by the debris flow.

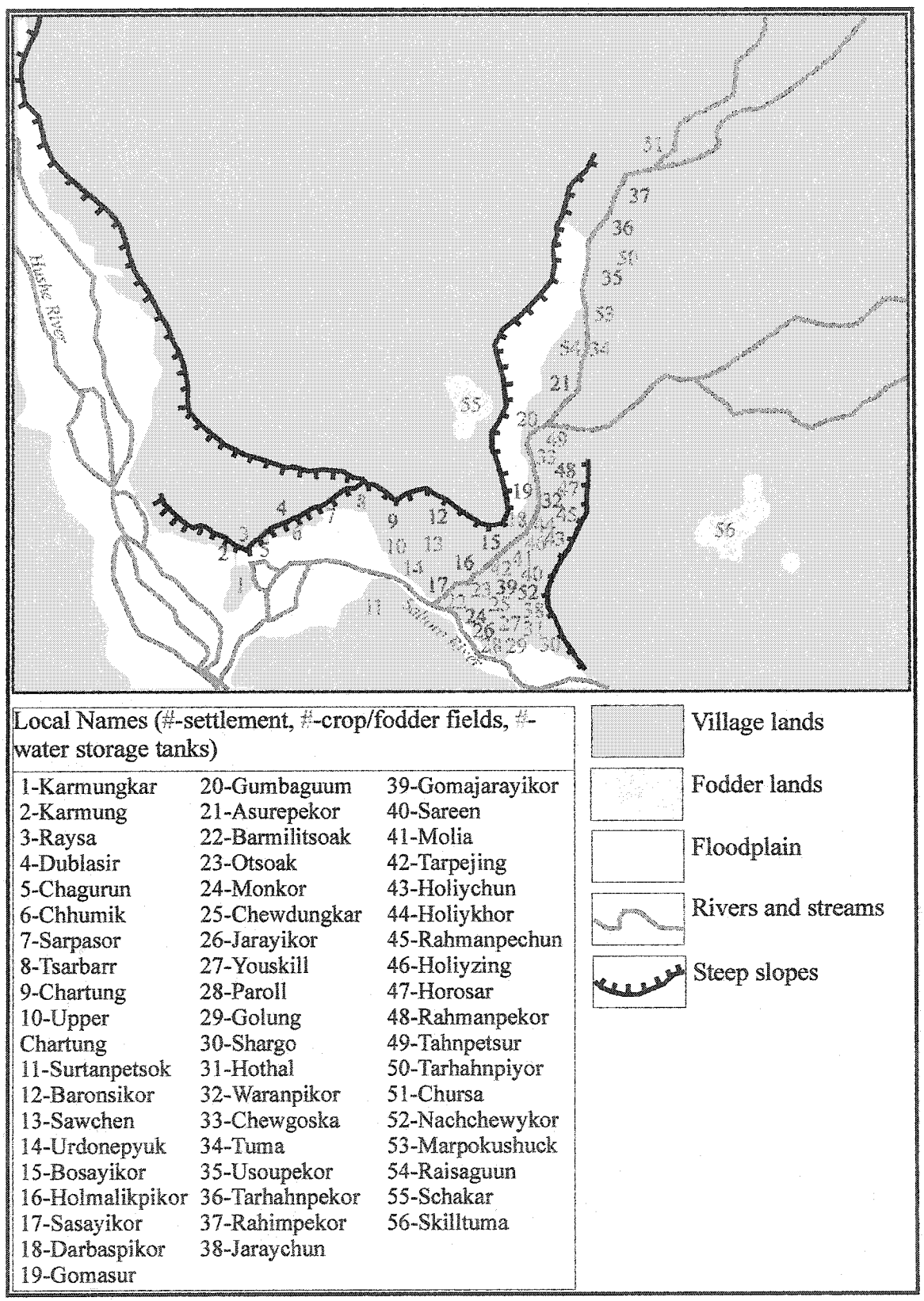
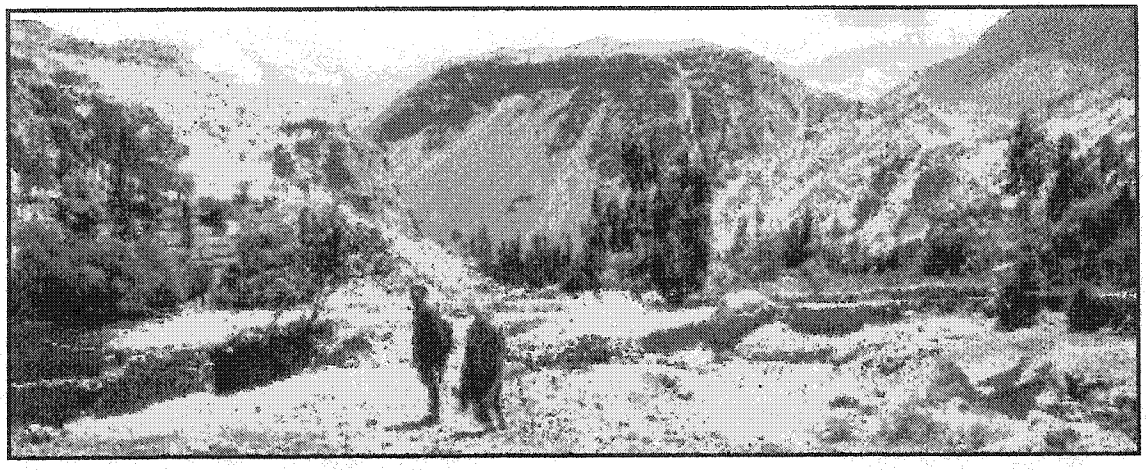
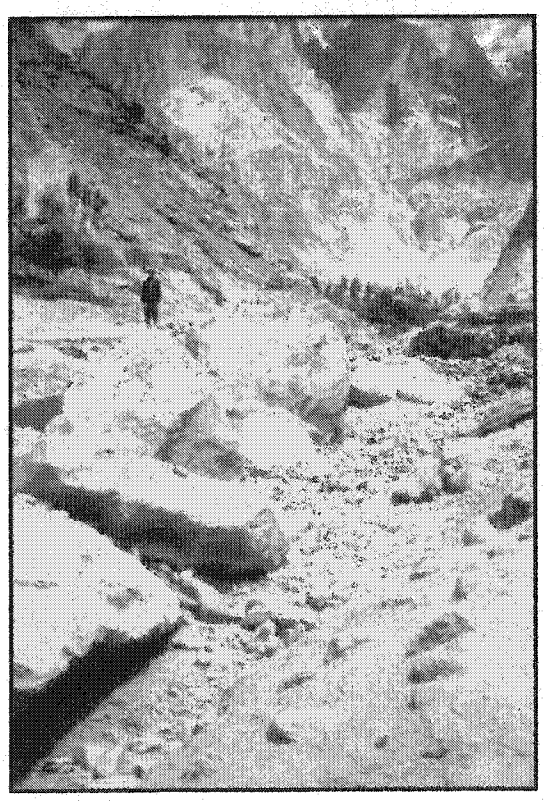


Figure 6.4: Social map of Haldi showing local names for village lands.





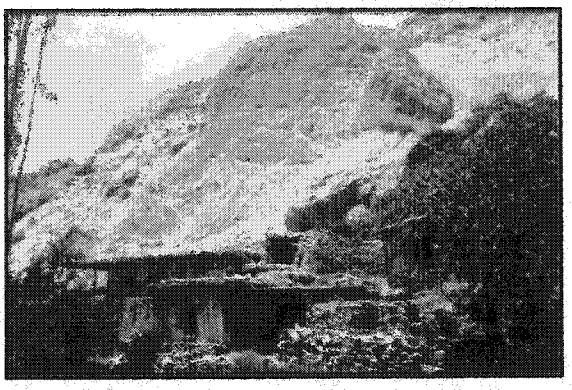


Plate 6.4 (top): A boulder-covered wasteland in Tarhahnpekor where 8 houses were destroyed by a debris flow in the late 1970s; note the one remaining damaged and abandoned house in the left foreground.
Plate 6.5 (bottom left): Megaclasts the size of houses litter the upstream reaches of the debris flow channel near Rahimpekor; Ali stands on one boulder for scale.
Plate 6.6 (center right): A house built under a large rock (*pong*) near the western edge of the rock-avalanche deposit—the rock served as a makeshift home for over a year when the family's home was destroyed by a debris flow.
Plate 6.7 (bottom right): The braided Hushe and Saltoro rivers are constantly changing course producing a cycle of land inundation and reclamation.

The channel in these sections is only about 2 m in depth, as opposed to 6 m in the uppermost and lowermost sections (transects five and one respectively). The shallow channels presumably result from erosion-resistant surficial materials in these areas. There is some morphological evidence to suggest that more shallow channels may also be related to reduced longitudinal gradients along the sediment fan resulting in reduced velocity and, thus, reduced ability to erode the channel (See Appendix D, longitudinal profiles one (downstream) through five (upstream)).

It would be expected that those transects near the apex of the fan and, those close to the confluence with a higher order river near the base of the fan, would have an increased gradient. Those not associated with such features would have a lesser gradient. This pattern is displayed by the longitudinal profiles sampled. Transects two, three and four have a low gradient (slope ranges from 0.0740-0.1010); transect one, near the confluence with the Saltoro river (slope=0.1235) and transect five, near the apex of the fan (slope=0.1475), have higher gradients.

Several smaller debris flow events have occurred since the late 1970s both within this well-defined stream/debris flow channel, as well as in new locations, creating tributaries to the main channel (See Appendix D, cross-sectional and longitudinal profiles six through nine). Tributary channels represent relatively novel hazards to the village and have the potential to increase and/or change who is affected by debris flow events. Heavy rains trigger smaller debris flow events in July and August that mobilize weathered material above and bring a surge of sediment-laden water through the village. Those households already affected by debris flow events, as well as several previously unaffected households, have lost cropland and livestock to these events. It is difficult to

know whether new tributary channels will continue to develop posing novel risks to areas formerly thought of as 'safe' within the village.

6.3.2 Flooding

Flooding is another commonly cited hazard by the residents of Haldi as it is situated at the confluence of two major rivers. The sources of the Saltoro and Hushe rivers are the heavily glaciated and snow-covered catchments at the head of their respective valleys. The rivers exhibit diurnal flow in summer with morning low flows and late afternoon peak flows. Warm summer days can result in large amounts of ablation and snowmelt in the humid high-altitude zone, resulting in significant increases in river discharge during late afternoon hours (Ferguson, 1984). These meltwaters generally have a high suspended sediment concentration and a high bed load due to readily available and easily mobilized materials in the proglacial environment.

Frequent fluctuations in river discharge, a very high bed load and a relatively steep and wide channel result in braided river systems. The channels within these braided river systems are continually changing their course throughout the summer season when fluctuations in discharge are at their greatest (Ferguson, 1984). Reclaimed village lands are inundated on an almost annual basis. The village is in an ongoing battle with the braided Hushe River, which changes its course and destroys fodder crops and woodlots located on its floodplain in the areas of Karmung and Litsoq (See Plate 6.7). In a similar manner, villagers have been repeatedly affected by high discharges along the Saltoro River that inundate the reclaimed floodplain and undercut terraced fields in the areas of Chartung, Chagurun, and Chhumik.

6.3.3. Other villager concerns

Villagers presented several other concerns during the course of my stay in Haldi. One such concern related to the amount of water available to each household for its cropland, both in terms of precipitation during the growing season and in terms of equitable management of the village's irrigation system. Moisture excesses or deficiencies can significantly affect the productivity of cropland (Hewitt, 1983a). The concern is moisture excess in regard to precipitation. Too much rainfall, or excessively heavy rainfall, can destroy village cropland by providing too much moisture or by flattening crops.

Moisture deficiencies often result from inadequate water supply during the growing season and inequitable use of available irrigation waters by villagers. Inequitable use is particularly detrimental to villagers at the end of the supply network. These villagers rely on the proper use of water resources by upstream users. During the growing season, irrigation water for crops and vegetable gardens is in high demand and specific irrigation times are assigned to each household in the village. The schedule continues over a twenty-four hour cycle. For those at the beginning of the supply line, it is assured that there will be no interference with their irrigation times. However, for those at the end of the supply line, there is no such assurance. These households are often left without water when it is their assigned time.

Other issues may also affect the equitable distribution of irrigation water within the village including insufficient flow and frequent disruptions to the supply line. Irrigation channels require constant maintenance to ensure the water supply never ceases. This is a common responsibility shared by villagers.

The short growing season, owing to the relatively high elevation of the village, can also be problematic. Fields must be sown in March or April to ensure they will be ready to harvest before colder weather arrives. Late-lying snow or late spring frosts may delay planting, while early autumnal frosts may harm crops before they are harvested.

Scarcity of land was also mentioned as a source of conflict in the village. Continuing conflicts existed between villages, local households and even within families. Inter-village disputes related to claims by other villages to common use areas currently used by Haldi for fodder production and livestock grazing. Disputes between local households generally concerned extended kin relationships and the historical division of land. Intra-household conflicts concerned the division of a father's land between his sons and daughters (although women often cede their right to land to their brothers).

Villagers frequently mentioned general health, access to health care and the availability of 'good' medicine as concerns. Several research participants commented on the frequency of illness in the village and blamed these illnesses on a combination of dirty water and poor-quality medicine. One research participant blamed Balti tea for villagers' ailments, a drink enjoyed by all in the village at least three times a day. Others were more concerned with their access to health care. Several women were concerned as they rarely leave the village and there is no health centre or hospital within the village confines. In addition, several people complained about the medicines provided by the local dispensary saying they did not work and were often beyond their expiry date.

6.4 Social Organization and Vulnerability

The community is made up of 130 households of a relatively homogeneous cultural and religious make-up. Most households belong to the Nurbakhshi Sufi order, only 16 households belong to the Twelver Shi`i order and 1 to the Sunni order. All speak Balti, derived from the ancient Tibetan language. The village is tied to several other villages along the Hushe and Saltoro valleys by kin relationships, social ties and a shared culture. Until recently, however, they have been relatively isolated from much of the modernization and development occurring in many Karakoram communities. This isolation was largely due to the absence of road access and their distance from the regional market town of Skardu.

The household is the basic productive and social unit in the village. Family types range from single nuclear families to large, extended families spanning three generations. Large, extended families seem to be the preferred type as this allows resources to be pooled within the same household. Average household size, based on the households visited, is approximately nine members. Households are grouped into distinct and separate neighbourhoods within the village. Grouped settlement supports strong social and economic relationships on the basis of neighbourhood and kin allegiances.

6.4.1 Vulnerability due to location

The location of a particular household in the village has a direct effect on their vulnerability to debris flow hazard. The sediment fan narrows towards its apex and is surrounded on both sides by large mounds of rock-avalanche deposits. Households and landholdings situated along this narrow section have been repeatedly affected by debris flow events over the period of settlement. In addition, the main river channel is poorly

developed through this reach. Channel walls are less incised and more easily topped than in wider downstream reaches of the sediment fan. Newly eroded debris flow channels along this section are also problematic, adding a new dimension of unpredictability to the hazard. It is often within this zone that sediment-laden waters overtop channel banks damaging homes and inundating villagers' lands and crops.

The settlements of Rahimpekor, Tarhahnpekor, Asurepekor and Usoupekor have been repeatedly damaged by debris flow events. These settlements, perhaps not surprisingly, are home to only a few households, and were settled after the main settlements were founded further downstream. That is, after more suitable lands were already occupied. The households situated in this area are some of the poorest in the village.

Other settlements within the village are vulnerable to other types of hazards. The settlement of Dublasir and surrounding village lands are more prone to small landslips due to steep terrain and terraced fields. Karmung and Litsoq, as well as Chartung, Chagarun, and Chuumik, are frequently inundated by floodwaters from the Hushe and Saltoro rivers respectively. Again, these settlements have relatively few households.

6.4.2 Socio-economic vulnerability

The status of a household is instrumental in dealing with adversity in the village, whether it relates to a dispute over water supply or recovery from a debris flow event. The distribution of power within the village results from two somewhat contesting factors. On one hand, there is the importance of religion to the lives of villagers and the esteem in which local religious authorities and scholars are held. Religious leaders and scholars are usually quite affluent compared to village standards and often have ample

landholdings within the village. Those households with close social or kin ties to these leaders often benefit from this relationship and improve their own social standing within the community.

A second, more recent distribution of power results from the introduction of the cash economy and, more specifically, participation in mountaineering and trekking activities. In this instance, power is not derived from respect or reverence, but from control over income-generating activities. Those individuals with social or kin ties to villagers in charge of organizing trekking and mountaineering expeditions are often employed during the summer months. This gives them the opportunity to hone their skills working with foreign clients, practice speaking foreign languages, and earn much-needed cash income. Villagers without these social ties miss out on these opportunities and may be unable to earn an income to buy provisions or save for future times of shortage.

6.4.3 Gender vulnerability

Haldi is an Islamic patriarchal society where women observe purdah. All of the households in the village are Muslim (most are Nurbakhshi). The division of labour within the village is primarily a gendered division (cf. Hewitt, F., 1989; Azhar-Hewitt, 1991, Gururani, 2002). Women perform the bulk of domestic responsibilities including cooking, cleaning, collecting water, washing dishes and clothes, and caring for dependants. They also perform essential tasks for the subsistence economy, including cutting fodder grasses, collecting wood, weeding, cutting crops, collecting fruit, drying fruit and smashing apricot kernels. They also irrigate fields and maintain irrigation channels, but this may be a task they only perform when there is a shortage of male labour in the village.

The majority of households rely on the mixed farming economy for their subsistence. The combination of these two factors means that while women's mobility is impeded to some extent due to their observance of purdah, for the most part, they are free to move about the village to perform agricultural tasks. Most households do not have sufficient resources to warrant keeping female household members secluded in the home. However, the restrictions placed on women vary within the village and are dependent on a number of other factors including age, marital status and household socio-economic status.

More restrictions are placed on unmarried women of marrying age and married women of childbearing age than on premenstrual or post-menopausal women. Girls marry at a young age in the village—as young as 14 in some cases. Most marriages take place between closely related family members, usually first or second cousins. Patri-lineal cousin marriage ensures that the social ties among kin groups remain strong and gives some assurance that girls will be cared for in their new households. When girls marry, they leave their father's household and join their husband's. This relocation can be a very traumatic experience for young girls, particularly if their husband is from another village, as, often times, they have never been more than a few kilometres from their father's home.

During summer months, Haldi is essentially a village of women, elderly men and children. Most young and middle-aged men are absent for the majority of the season earning incomes outside the village. Men find work as guides, porters, cooks, soldiers, teachers, computer programmers and religious scholars within the Northern areas or further afield in lowland Pakistan or nearby countries. The out-migration of men for off-

farm employment amplifies the already elevated vulnerability of women to damaging events.

Debris flows occur from June through August in Haldi. This timing corresponds with two significant events; namely, the peak season of crop production and activities related to the agricultural economy and the height of male out-migration for employment. Women are under great stress during these months as their usual domestic and agro-pastoral tasks are supplemented by tasks usually performed by male household members. Female villagers are particularly vulnerable to debris flow events during this time. Their safety is compromised during the crisis by their responsibility for children, the elderly and livestock housed in the village. Following a damaging event, women's poor access to resources (such as cash to buy provisions) is problematic as men are absent and cannot be called upon for assistance.

6.5 Traditional Social Responses to Hazard Events

Villagers employ a range of risk-averting strategies to reduce their vulnerability to environmental fluctuations. Foremost among these is the use of horizontal and vertical gradients for the agro-pastoral system. Villagers reduce their overall vulnerability to any one damaging event through the spatial dispersion of livelihood activities and the use of various ecological niches (cf. MacDonald, 1994; MacDonald, 1998). Similar strategies in other Karakoram villages have been interpreted as evolving from the risk-inherent environment in which villagers live and not as a response to any particular known or potential hazard (cf. MacDonald, 1998). This interpretation seems to apply to Haldi as well, but with one notable exception.

There is a predominant pattern of field dispersal in the village. All households own a number of small plots scattered across the available productive lands. Field dispersal ensures that no individual household has disproportionate landholdings concentrated on good quality land near the village or, conversely, on poorer quality marginal lands further from the village (cf. MacDonald, 1998). Dispersed landholdings effectively minimize the risk to any one household by distributing potential damage to fields and crops over the largest possible area of productive space (cf. MacDonald, 1998). The primary advantage of this system is the potential to exploit land of varying quality, microclimate, and topography. In addition, field dispersal reduces the likelihood that all fields and crops are damaged due to any one particular hazard and thereby reduces the potential of a subsistence crisis.

Of course, there are drawbacks to having fields dispersed over a wide area, particularly the time and labour costs involved in tending to them. In some instances, villagers must travel substantial distances from their households to reach their fields. This must be done several times a week in order to irrigate, weed and properly manage their fields. Despite the added labour and time demands of traveling long distances to perform agricultural duties, crop production is usually not inhibited (cf. MacDonald, 1998).

The other component of this dispersal system is verticality or the exploitation of different ecological zones over a range of elevations (Hewitt, K., 1989). There is not a large vertical component to crop production in Haldi, however, altitudinal differences produce ecological zones that are very useful for other aspects of the mixed farming economy including fodder production and grazing lands. Again, by dispersing village resources over several zones, the risk to any one household is significantly reduced. It

would be near impossible for any one event to affect the whole of the livelihood system in the summer months.

Although the spatial structure of landholdings in Haldi does minimize risk, it is problematic to interpret this as an intentional risk-minimizing strategy (MacDonald, 1998). Few residents explicitly cite risk reduction as the reason behind field dispersal. Instead, the system is in place because 'it is the way things are done' in the village. The current system likely evolved, through trial and error, over hundreds and maybe thousands of years. The original reasons behind the system related to historical settlement patterns, the opening up of lands along irrigation lines and environmental constraints affecting village lands. The system remains intact because it is meaningful to villagers for historical, social and cultural reasons beyond the obvious material benefits of reduced losses.

The one possible example of purposeful risk minimization is the avoidance of lands previously damaged by debris flow events in the neighbourhoods of Rahimpekor, Tarhahnpekor, Asurepekor and Usoupekor. The main channel and lands immediately adjacent to it have not been reclaimed since they were inundated by the major debris flow flow event in the late 1970s; only a small portion of the outer edges of these deposits have been brought back into production. However, it is difficult to gauge the reasons behind villagers' decisions not to reclaim this land. Possible explanations could be the potential for hazard in the area or the labour required to bring the land back into production.

Social responses to hazard events have varied widely in the community and relate to the severity of the hazard and the options perceived to be available to community

members and households. For those who lost their homes to damaging events, the range of responses included rebuilding their homes in the same location, rebuilding their homes in a different location within the village, moving in with close kin both within and outside the village and choosing to rebuild their home in another village. Household decisions were often based on the extent of livelihood losses and the social and kin connections available to them. Villagers have also relied on kin and social groups to supply food in the aftermath of a damaging event although purchasing food from Khapalu is becoming the more frequent solution.

In the case of the high-magnitude debris flow event that occurred in the late 1970s, at least fourteen households chose to move to Thagas, Ghorsay or other nearby villages rather than rebuild within Haldi. This particular damaging event was so overwhelming that starting new in another village was perceived to be as easy, if not easier, than starting over in Haldi due to the support of close kin in other villages. These close-knit kin and social ties allowed the necessary support for such a change.

Those without this external support system generally remained in Haldi and relied on kin relationships or social ties within the village to relocate or rebuild. Some of the affected households moved into the already-established homes of their kin. Those households without these ties fared the worse. Many were forced to rebuild in the same area due to land constraints in the village. Several households rebuilt in the shadow of the rock-avalanche deposits to the west of the village, barely avoiding their previous home sites.

Those households without strong ties suffered the most following this debris flow events. Many of these households were already some of the poorest in the village prior to

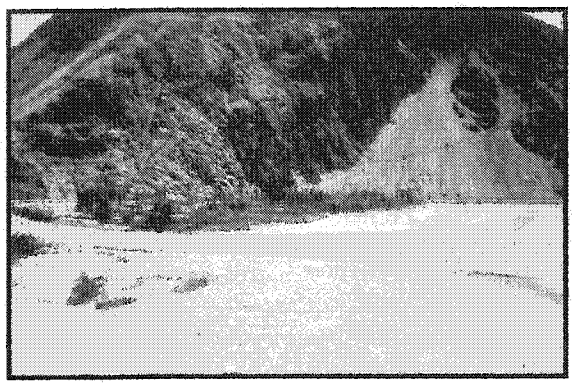
losing their homes. One woman and her family lived under a large boulder suspended in the rock-avalanche deposits for over a year before they were able to rebuild their home. Outside assistance from the government was not provided following the damaging event, despite the fact that several households asked for assistance.

Many more households lost crops than lost homes in this event due to the system of dispersed landholdings in the village. Most have since been reclaimed and replanted in the same location. The villagers are aware of the obvious risks of replanting in previously affected areas but feel they have no choice, as there is no more available land within the village and land left out of production affects the overall irrigation network. Disputes over land are common in the village and occur at many levels—between villages, between neighbourhoods, between households and even within families.

Following more recent debris flow events of lesser magnitude, the number of households that relocated outside of Haldi was much smaller. Most households remained within the village and replanted crops in the same locations. As in previous instances, social and family ties within the village facilitated the recovery of these households. Community members helped to repair homes, clear fields of boulders and replant fields with quick-maturing crops such as buckwheat. They often also supplied food, although buying food from external markets is becoming the more frequent solution.

The frequent losses of cultivable land within the village, coupled with local land constraints and the growing population, have caused villagers to try to bring previously uncultivated land into production. This effort has been concentrated on the floodplains of the Hushe and Saltoro rivers on lands that adjoin current sites of crop production (See Plate 6.8). Rock fences are built to keep floodwaters away and stones are cleared to open

up fields. However, these lands are still frequently lost to annual floods and changes in the braided river channels along the Hushe and Saltoro Rivers. These events often topple or overtop structures built to keep floodwater at bay. Despite the frequent losses, villagers continue to reclaim these lands in the hopes that their crops will reach maturity before the annual flood.



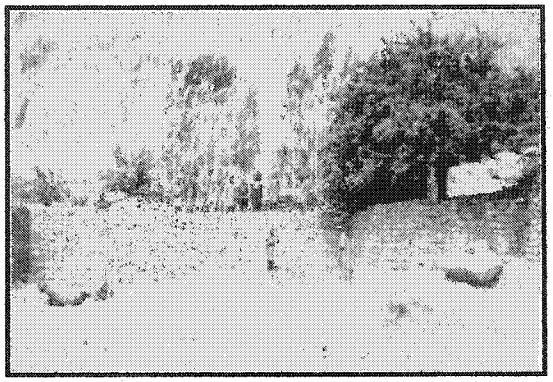


Plate 6.8 (left): Land is being reclaimed along the Saltoro River; note the stone fence extending from center left of the photograph.
Plate 6.9 (right): A large *zing* was constructed in the village in 2001.

The villagers have also responded to the water shortages that frequently affect village lands. This has been done through the construction of several *zings*, which may best be described as water storage tanks made out of rock (See Plate 6.9). These structures also have several other benefits. They allow irrigation water (which is essentially turbulent, glacial meltwater) time to settle and warm to a more suitable temperature before being applied to crops (D. Butz, 2003, pers. comm.). The village already has several small- and medium-sized *zings*. In addition, a much larger *zing* is being constructed near Rahimpekor. Once completed, this structure will allow irrigation water to be stored overnight and released in the morning, thereby eliminating the necessity of overnight irrigation practices (Joekes, 1995).

6.6 Modernization and Vulnerability

Several recent changes have occurred in Haldi that affect the distribution of risk in the community. Twelve years ago, a dirt access road was built that connects Haldi to the larger regional centres of Baltistan. Skardu, the major commercial centre of the region, is situated 115 km away along this jeep road, while Khapalu, the administrative centre of Ghanche District and the most prosperous of Baltistan's old kingdoms, is only 15 km away. Khapalu has many amenities not available in Haldi such as higher education, a bazaar, a civil hospital and a dispensary with 'good' medicine (meaning it is not expired).

The building of the road facilitated much of the present and ongoing change within the village by connecting it to nearby and distant centres (cf. Allan, 1989; Kreutzmann, 1991; Kreutzmann, 1993; Kreutzmann, 1995). The road allowed national and international tourists to enter the region much more easily than they could before its construction. Increases in tourist activities brought a corresponding increase in guiding and portering jobs. Many local men have been seasonally employed in this industry. In addition, the building of the road facilitated interactions with other centres. Many local men have found off-farm employment in lowland centres. The overall result has been seasonal and longer-term male out-migration from the village.

The introduction of the tourist industry has changed the distribution of resources and productive tasks in the village. The majority of men who earn cash income are employed as guides or porters for mountaineering and trekking expeditions. Tourism is a growing industry within Northern Pakistan and particularly within eastern Baltistan. The Hushe valley is already a well-known destination for tourists interested in these activities,

as the head of the valley provides ample opportunity for traversing glaciers and scaling peaks. The Saltoro valley is closed to foreigners unless a special permit is obtained in Islamabad. However, in 2001, several mountaineering and trekking expeditions were granted access.

Although employment as a guide or porter provides good wages for village men, it also exposes them to a range of new risks associated with these activities (MacDonald and Butz, 1998). Porters are required to hike in steep terrain carrying large loads. They are often not supplied with adequate clothing, equipment or food. Instead, they wear what clothes they have (generally a shalwar kamiz, a blanket and plastic shoes, unless they have been given old coats or hiking boots from previous foreign clients) and strap loads to their backs using rope. Large loafs of bread, yak cheese and chai are their main sources of sustenance on the trail. The combination of inadequate clothing and equipment, and insufficient food supplies, often results in fatigue and injury.

Most men employed in the tourism industry spend the majority of the year in the village. The exception, of course, is the tourism season. This timing coincides with the majority of agricultural activities and potential debris flow activity. Young, strong men are often absent from the village for long periods of time in the summer months. Their absence produces a shortage of labour in the village and often leaves women, children and the elderly with increased workloads during these months. In addition, this is the time when debris flows are most frequent. Men told of times when they watched from above as debris flows descended on the village. They did not know whether their families were safe or not, and were unable to leave expeditions to come to the aid of the stricken village.

The building of the dirt road has also facilitated male out-migration for employment opportunities further afield. Several men have left the village for extended periods of time to become cooks in Lahore, police officers in Karachi and military officers. Their wives remain in the village and remittances are sent to local household heads.

Although several local men take part in the cash economy and earn an income, significant improvements in local conditions have not yet occurred. Men rarely spend their money on items that benefit their household or the village as a whole. Instead, most save their earnings or buy luxury items such as cigarettes, watches, sunglasses and wall clocks. Some of the more wealthy men have built or purchased homes in Skardu and Islamabad, while their village homes remain the same. The wives and daughters of these men will likely never see these houses, as it is unlikely they will ever travel such distances.

Foreign donors have funded the limited amount of development evident within the village. Most of these donations are from individuals who met local men during tourism-related activities and were later invited back to the village. Most of the projects to date have focused on building infrastructure within the village. Examples include the only school for girls and the middle school for boys. While these projects provide infrastructure that would not be built otherwise, they do not address the underlying issues that contribute to the village's poverty.

The first school for girls was completed in 2001 and a middle school for boys was built in 2000. Foreign donors provided the funding for both projects. Education is provided up to 5^{th} class for girls and up to 7^{th} class for boys within the village. Until

recently, however, classes for girls took place outside under a large tree enclosed by a stone fence. Household heads wishing to educate children past these grade levels must send them to other villages to continue. Girls can go to the nearby village of Ghorsay for 6^{th} and 7^{th} class. However, few continue past 5^{th} class, and even fewer continue past 7^{th} class. In the entire village, only 1 girl has achieved her matriculation (or 10^{th} grade equivalent). Boys can continue their education in Skardu or Khapalu and often stay with relatives while attending school.

Recent and future development projects funded by the Pakistani government include the introduction of *bijli* (electricity) and the construction of an irrigation pipe. Electricity was first brought to the village in December of 1999 after a hydropower plant was built near Thagas. The current supply is inconsistent. However, a development project has already been approved that will change the output from 25 kW to 100 kW. This change will result in a more stable power supply within the village. The Pakistani government has also agreed to fund an irrigation pipe to improve the supply of water to fodder areas. Local men will be employed to build it.

Most women interviewed thought recent changes within the village were good but had little or no effect on their lives. Men, on the other hand, discussed recent changes more fully and often spoke of some not mentioned by women. They were also more enthusiastic about the changes, and saw them as having a dramatic effect on the quality of life within the village. It is difficult to know why women only spoke of some changes and not others. It is possible that they are unaware that certain projects, specifically those taking place outside the village (such as the new hydropower plant), are taking place. Or

perhaps they only discussed projects that they thought were most relevant to their lives within the village.

When research participants were asked what changes they would like to see in the village in the future, many of them, particularly women, had no suggestions. This may have been due to the presence of other community members during interviews and women's unfamiliarity with being asked for and voicing their opinions. The few that did offer suggestions focused on improvements in changes that have already occurred, such as a more consistent supply of *bijli*. The one exception was a young, out-spoken woman. She offered several suggestions including a sewing centre, more middle and high schools for girls and boys, an Islamic studies centre, and a social work school. Most men offered several suggestions and focused on local infrastructure including building a hospital, paved road, middle school and high schools.

6.7 Concluding Remarks

Haldi has experienced several damaging events over its history of settlement. Debris flow and flooding events are recurrent hazards affecting village livelihoods. Several families have lost their homes or crops to one or more of these events. However, close kin and social ties within and outside the village have ensured that most community members recovered. Through repeated exposure to damaging events, the community has developed a considerable capacity to withstand stress. This is mainly accomplished through an agro-pastoral livelihood system that is highly dispersed, both within the village proper through scattered plots of land, and zone of permanent settlement through the utilization of altitudinal gradients and ecological niches.

Several factors contribute to differential vulnerability to debris flow hazard in Haldi. The foremost among these are household location, socio-economic status and gender. Household location is a critical factor in Haldi as debris flows have repeatedly affected the same village lands. Villagers often have little choice but to replant and/or rebuild in the same location due to land constraints. Socio-economic status is also an important factor affecting vulnerability and relates to a household's resources, kin relationships and social ties within and outside the community. In Haldi, affiliation with religious leaders and men in charge of tourism-related activities is beneficial for households. Differential vulnerability within the household primarily results from the distinct and gendered separation of productive tasks, space and influence within the community, although vulnerability is also mediated by age, affluence and socio-economic status. Women are generally more vulnerable than men. This vulnerable condition has generally increased as a result of male out-migration during the peak season of agricultural and debris flow activity.

Social responses to damaging events vary within the community and depend on the severity of the hazard and the accessibility of social and kin ties within and outside the village. Higher magnitude events have resulted in considerable out-migration of village residents due to near complete loss of the livelihood system and close kin ties in nearby villages. Other households remain in the village and move into the households of extended kin or rebuild on their own, usually not far from their original home sites. Those households with few social ties in the community have a difficult time in the aftermath of a damaging event; some have remained homeless for over a year. Lower magnitude events usually result in different social responses. Most households remain in the village

and replant crops in the same location, as land constraints within the village prevent replanting elsewhere. Food is usually provided by extended family members during the crisis period, although purchasing food from external markets is becoming much more frequent.

The introduction of modernizing influences and the cash economy has not brought significant improvements to village life. Haldi remains, for the most part, a poor village. Those community members that have managed to accumulate wealth have usually accomplished this through control over tourism-related activities and the exploitation of other community members. Although male community members are earning significant amounts of income through off-farm employment, money is seldom spent on projects to improve conditions within the local community or even their own household. Instead, money is often spent on luxury items that benefit men alone.

There is no formal organization among villagers to improve the poor conditions within the village, nor any significant involvement from external development agencies to assist in the process. In this present context, little can be accomplished internally to improve the livelihoods of villagers. As a result, development remains a haphazard process carried out by the Pakistani government and foreign donors; critical resources such as formal education and health care continue to elude the community.

CHAPTER VII:

DIFFERENTIAL VULNERABILITY IN NOMAL AND HALDI

7.1 INTRODUCTION

A considerable amount of work pertaining to mountain societies, including that focused on the Northern Areas of Pakistan, has suffered from regional generalizations (the prime example being Eckholm, 1975). There has been a tendency to homogenize the impacts of environmental hazards and the effects of modernization processes over the entire region (Ives and Messerli, 1984; Allan, 1995). Relatively few studies have attempted to capture some of the immense diversity that actually characterizes the region (recent exceptions being the International Karakoram Project (Miller, 1984) and the Pakistan-German Research Project (Stellrecht, 1997).

Despite the various similarities of landscape development and hazard history in the two villages chosen as case studies, they have distinct and locally adapted ways of dealing with hazardous events. The villages have important differences in their resiliency and ability to respond to these hazards. It is my contention that each village faces a distinctive set of environmental opportunities and constraints and has a distinct local history, social organization, and cultural and religious tradition. The distinctiveness of each place means that vulnerability to environmental hazards and responses to these hazards differ greatly between villages. Increasingly, however, differences in the vulnerability of villages, and their ability to respond to damaging events, result from the pace and forms of modern influences (Hewitt, F., 1989; Butz, 1993; MacDonald, 1994). The extent to which these modern influences are incorporated, as well as the rate at which

they are implemented, affect the conditions of everyday life and livelihood systems in the communities, and consequently, the vulnerability of community members.

It is important to remember that vulnerability not only varies between villages, but also within villages, due to complex social, cultural, economic and political circumstances (Blaikie *et al.*, 1994; Enarson and Morrow, 1998). How these circumstances benefit some villagers more than others is important. This chapter outlines the various factors that contribute to the differential vulnerability evident within and between the two village case studies.

7.2 Environmental Opportunities and Constraints

The hazard histories of Nomal and Haldi are very similar. This similarity was incorporated into the study by design, in order to examine how comparable hazard events affect human populations differently due to the distinctiveness of local systems. We have already discussed, in the previous chapters, how village organization puts some individuals and groups within the villages at greater risk in the event of a damaging event, and less able to cope and respond in the aftermath of that event. This section looks at how differences in environmental opportunities and constraints between the villages affect their overall vulnerability to hazard events.

The role of the physical environment is integral to an understanding of the differences between these two villages. Nomal, at an elevation of 1600 masl, experiences higher temperatures and a longer growing season than Haldi, which is situated at 2700 masl. Nomal lies within the double-cropping zone and is therefore able to produce more

crops over the course of its growing season. Haldi lies within the single-cropping zone, and is more dependent on the productivity of a few crops for its livelihood.

The lower elevation of Nomal, relative to the elevation of Haldi, benefits other aspects of the agro-pastoral economy as well. Fodder crops and high pastures, which are attitudinally dispersed outside the main village, are productive for longer periods of time. Nomal has extensive fodder areas and high pastures at lower elevations than those belonging to Haldi. Due to their lower elevations and resultant higher temperatures, these areas remain productive for a longer length of time. Nomal seldom has trouble producing enough fodder, and can graze their animals from May to October in their high pastures. Haldi has a much smaller window to produce fodder and graze livestock in summer pastures.

The differences in where the villages are located affect the overall vulnerability and resiliency of their livelihood systems, as well as the benefits and opportunities afforded to each village by the local physical environment. The location of Nomal results in a more productive agricultural system due to a long growing season and fodder and grazing sites at lower elevations. In contrast, the location of Haldi results in a relatively less productive livelihood system characterized by a short growing season, and fodder and high pasture sites that are useable for a shorter period of time.

The timing of damaging events also has a critical role in developing an understanding of differential vulnerability between the two case study sites. The peak time for debris flow and flooding events corresponds with the growing season. However, the consequences of a damaging event near the beginning of the season may be very different from one during harvest season. In the former instance, villagers are often able

to respond by replanting quickly maturing crops in place of those lost, thereby averting total crop losses. In the latter instance, villagers are often unable to replace their lost crops. Such scenarios would have different outcomes for each of the two villages due to differences in their agricultural production.

As Nomal has two crops per season and, in general, a surplus of agricultural products being produced in the village, most households would be able to absorb such losses. The greatest effect would be on cash income earned that year; crop losses would not significantly undermine subsistence for most village households. In Haldi, however, such losses can have a more immediately threatening effect as households rely on a single growing season to produce enough food for sustenance throughout the year. In past times, this has resulted in food shortages, nutritional deficits and even starvation for villagers. The most likely present-day outcome would be a significant reduction in household wealth, with villagers having to use savings from off-farm employment, and/or sell or barter livestock, to buy food at the market.

The varying characteristics of hazard events also produce differences in vulnerability between the villages. Debris flow events are a common event in both villages; however, the proportion of village lands and the number of households affected by these debris flows vary. Debris flow events in recent years have mostly affected lands in the westernmost portion of the Nomal settlement. This area is not currently used for crop production. Instead, fodder and fruit trees are cultivated, and a substantial woodlot buffer is maintained. As a result, recent debris flow events (which have been of a lower magnitude than debris flow events in the 1970s) affect a small proportion of the arable land within Nomal. Damage has mainly been to fodder crops and fruit trees.

In Haldi, recent debris flow events (again, also of a lower magnitude than in the 1970s) pass through the centre of the village, along the main stream channel. Many households own land adjacent to this stream, as it is the main source of irrigation water for the village. As a result, they are more directly and repeatedly affected by debris flow events. Haldi has also experienced a somewhat novel hazard over the past 10 years, as several debris flow events have not followed the established course. Instead, new debris flow channels have been formed and have affected village lands previously thought of as 'safe'. It is likely that new debris flow channels will continue to develop, disturbing previously unaffected village lands.

Thus, in Nomal, recent debris flow events have affected fewer households and have had a negligible affect on cropland, although fodder fields and fruit trees have been affected. In Haldi, many households are affected by debris flow events that pass through the centre of the village and inundate valuable cropland situated near the stream channel. In this sense, Haldi is more vulnerable to debris flow hazard. However, this situation is certainly not static. The characteristics of debris flow events change (their magnitude, frequency, duration, spatial extent, temporal spacing), as do the characteristics of the livelihood systems where these events occur (Burton *et al.*, 1993). In Nomal, villagers have asked the government to supply money to build an irrigation channel that would supply water to the westernmost area of the village; that is, the area currently affected by debris flow events. Such an endeavor would most likely result in an increase in cropland losses to debris flow events within the village. Similarly, the smaller magnitude events of recent years in Haldi may produce a false sense of security within the village, and result

in the reclamation of lands immediately adjacent to the stream channel. Reclaimed lands would most likely be lost when a higher magnitude event occurs.

7.3 Village Cohesiveness: Social Homogeneity versus Heterogeneity

The villages of Nomal and Haldi have distinct ethno-linguistic and religious traditions based on separate local histories (Kreutzmann, 1993; Reick, 1997a; Reick, 1997b). Within Nomal, there are two main groups: the Twelver Shi`ites and the Isma`ili Hunzakuts. Whereas the Shi`i population has been in the village for centuries, the Isma`ilis emigrated from the Hunza region and began settling the area in the 1940s (Kreutzmann, 1993). Residents of the two sects are split into separate and distinct villages as a result of the history of settlement; this split is reinforced by their cultural and religious separation. There is limited interaction between the two groups, as most projects are proposed and implemented based on neighbourhood village organizations. In this sense, the village functions more like two distinct communities, rather than one cohesive village.

The social and cultural separation of these two communities has, in some ways, strengthened the ties between villagers of a common ancestry. An "us" and "them" mentality permeates village life. Isma`ilis view themselves as a progressive and educated people, and see the Shias as somewhat 'backwards' due to their more orthodox beliefs and their perceived reluctance to 'develop'. The Shias, in turn, feel that the Isma`ilis are too lax in their interpretation and practice of Islam, and too eager to participate in development projects that change the character of village life. These perceptions keep Shias and Isma`ilis separate, thereby reinforcing stereotypes of what it means to be a Shi'i

living in Nomal and what it means to be an Isma`ili living in Nomal. Strong social ties within the Shi'i and Isma`ili communities exist well beyond extended kin relationships to include neighbourhoods and the entire religious community. Thus, the presence of two distinct communities in the village results in identification with, and greater social ties to, a greater proportion of one's own community.

The situation is quite different in Haldi. The majority of households belong to the same religious sect, as well as the same cultural and linguistic tradition. Haldi villagers are Nurbahkshi Shi`ites and speak Balti (Reick, 1997a). The relatively homogeneous nature of socio-cultural characteristics in the community means that their cultural identity is not threatened (although this may be changing as a result of increasing external influences). While one would assume that the uniformity within the village would contribute to an overall sense of community and identification with the village as a whole, this does not seem to be the case. Instead, there seems to be a considerable amount of jealousy and rivalry within the community (F. Azhar-Hewitt, 2003, pers. comm.). Social organization is more commonly based on extended kin group relationships. It is within these groups that decisions are made. Therefore, despite the relatively uniform or homogeneous nature of socio-cultural characteristics, the village lacks cohesiveness.

This distinction between the two study communities is crucial for development workers and researchers working in the communities. Villages of a homogeneous nature, that is, sharing a common ancestry, religion and language, may be more fragmented and have more interests that need to be heard from, than villages that appear to be more heterogeneous. In Nomal, the presence of two distinct communities threatens, and simultaneously reinforces, individual community identity. The historical and socio-

cultural factors that result in both the physical and social separation of the Shi'i and Isma'ili communities, have lead to greater identification with their respective communities. Social ties within each of the communities are widespread and cohesive. In Haldi, despite its relatively homogeneous cultural composition, households more commonly identify with their extended kin groups. This alignment may result from the lack of internal and external threat to cultural identity at the present time. However, the increasing influence of external processes may change this situation and result in greater village cohesiveness.

7.4 Socio-Economic Status

The vulnerability of a household is related to their socio-economic status within the village (MacDonald, 1994; Hewitt, 1997a). As was discussed in the previous case studies, those households with access to resources and assets, and who have considerable social ties within the village, generally fare better than those without comparable access to resources and social ties (Blaikie *et al.*, 1994; Enarson and Morrow, 1998). However, the factors influencing socio-economic status differ between villages and change over time.

In both villages, socio-economic status has traditionally been tied to historical conditions pertaining to ruling kin groups, religious scholarship, and the partition of village lands, (of course, the nature of these conditions vary between villages). Those households with direct ancestral or indirect social connections to ruling families or religious scholars, and who consequently inherited extensive amounts of village lands, and/or maintained their social status and connections, generally have a higher status

within the village. These same factors continue to affect socio-economic status at the present time, but are increasingly mediated by modernizing influences that change the distribution of wealth and access to resources within the communities (Kreutzmann, 1991; Kreutzmann, 1995). However, it is usually those households already having sufficient access to resources and social ties that are able to take part in new development initiatives, and, consequently, benefit from modern influences.

The factors influencing intra-village socio-economic status can be extended to examine inter-village differences in socio-economic status. The status of a village is related to its access to resources and assets, and its social ties to other villages, cities, nations, and the larger global economy (Hewitt, 1997a). Those villages with access to resources and with extensive social networks generally fare better than those villages lacking these resources and social networks. While this may be generally true at the village community scale, a later section concerning modernization will describe how the pace and modes of modernization may produce an opposite effect within villages. However, in terms of the present section, this conceptualization is useful to an understanding of the present differences in socio-economic status between the village communities.

It is probably more useful to discuss the Shi`i and Isma`ili communities of Nomal separately, as they are essentially organized, and operate, as two distinct villages. When this distinction is made, it becomes apparent that the socio-economic status of the Isma`ili community differs greatly from that of the two other Shi`i communities; that is, the Twelver Shi`i community of Nomal, and the Nurbakhshi Shi`i community of Haldi. The differences between the communities result from the social ties the Isma`ili community

has maintained through their resettlement (Kreutzmann, 1993), and through the social network promoted by the leader of the Isma`ili sect, the Aga Khan (Khan and Khan, 1992).

Beginning in the 1940s, many Isma`ilis originating from the Hunza region relocated to nearby settlements situated along the Hunza valley (Kreutzmann, 1993). Population pressure in the Hunza region is often cited as the main impetus behind this out-migration. Despite these new settlements, many relocated Isma`ili households still identify closely with their ancestral homeland, and retain their kin and social ties with the region. In this manner, connections between the Isma`ili homeland and smaller offshoot settlements remain strong (Kreutzmann, 1993). The Shia communities do not have this same history of relocation and, as a result, do not have these same connections with nearby villages. Their present home and ancestral home are one and the same.

The Isma`ili community of Northern Pakistan is also well-connected to the global Isma`ili community (Khan and Khan, 1992). These extensive ties have come about as a result of the policies and programs of the former religious leader (or Imam), Aga Khan III, and his grandson and successor, Aga Khan IV. Aga Khan III and IV have been particularly concerned with the affairs of Isma`ili followers worldwide, and have promoted policies for social and educational reform that have benefited not only their followers, but other Muslims as well (Daftary, 1998). Through a complex institutional network, generally referred to as the Aga Khan Development Network, the connections between local Isma`ili communities, and the wider Isma`ili community, are facilitated. While Shia communities do have some ties to religious centres outside the Northern Areas (such as Iran), they are not nearly as extensive and locally relevant as those of the

Isma`ili community (Schimmel, 1982; Richard, 1995). Thus, the Isma`ilis have gained considerable socio-economic status, both within and outside the communities, through their connections with distant lands.

7.5 Gender Vulnerability

As was evident in the previous two chapters, women are a particularly vulnerable group in both of the communities studied. Some of the factors responsible for the heightened vulnerability of women, in general, are common to both study sites. These reasons will be discussed in the first part of this section. However, vulnerability is not uniformly distributed among all women. Several mediating factors including age, affluence, and religious sect influence the degree of vulnerability women experience within their respective communities (Hewitt, F., 1989; Bolin *et al.*, 1998). These factors will be discussed in the second part of this section. Increasingly in recent years, modernizing influences are changing the conditions of everyday life within the villages, and are consequently changing women's vulnerability (Hewitt, F., 1989). The changing conditions of women's vulnerability as a result of modernization processes will be discussed in the final part of this section.

7.5.1 Women's heightened vulnerability

There are several factors that contribute to the heightened vulnerability of women and girls within the study communities. In part, women's increased vulnerability results from Islamic, patriarchal beliefs (Richard, 1995; Shah, 1996) and their manifestation in community social organization through the gendered division of labour, space and influence (Enarson and Morrow, 1998). Women's vulnerability is reinforced by the way

women perceive themselves and through their internalization of societal roles (Herbers, 1997), as well as by the way in which 'outsiders' to the community, such as development workers and researchers, have viewed (or ignored) and represented (or misrepresented) village women (Carpenter, 1991; Philo, 1992; Otsyina and Rosenberg, 1999).

Islamic women observe *purdah*, a system of norms and rules of behaviour that aims to prevent, or at least reduce, the contact between unrelated men and women (Herbers, 1997). As a result of this system, women are more confined to 'private space', such as the home and its immediate surroundings, and perform distinct and separate tasks from those tasks performed by men (Hewitt, F., 1989; Joekes, 1995). Productive resources, such as land, are generally passed down from father to son(s), despite the rights of daughters to inherit some of their father's land (Joekes, 1995). Women are usually pressured into ceding their rights to land to their brothers. This is done to keep land in the father's household and to avoid subdivision of already small landholdings. The ability of women to access other resources, such as education, and health care, and to participate in decision-making forums and income-generating activities, is also limited due to patriarchal customs and women's observance of purdah (Gupta, 1987; Ibraz and Fatima, 1993).

As was discussed in the previous chapters, there is a marked gender division of labour within the study communities. Men and women perform distinct and separate tasks for the agro-pastoral economy. Women are responsible for the majority of domestic tasks including collecting water, cooking, cleaning, laundering, and caring for children, the sick and the elderly. They are also responsible for a large share of agricultural tasks related to domestic crop production, including: weeding, cutting, and drying crops; collecting,

splitting and drying fruit; cracking apricot kernels, and preserving food for the winter months. Men are responsible for planting seeds, ploughing and threshing, and usually livestock rearing. However, the absolute delineation between male and female tasks varies from village to village (Hewitt, F., 1989; Joekes, 1995).

In addition to the gendered division of labour, there is also a gendered division of space in the study communities. Women are responsible for the majority of tasks that take place in close proximity to the household, while men are responsible for the majority of tasks that take place further away (Herbers, 1997). Thus, during productive hours, women and men often occupy different spaces. Women gather in their fields, vegetable gardens and kitchens to discuss village matters, while high pastures, main roads, bazaars, and local mosques are the preferred gathering places of men. Men may occupy the same spaces as female relatives to oversee household activities. However, the reverse is not true; women are not seen where men congregate.

The ability to influence decisions concerning household and village life is also divided by gender. Men are almost always the heads of households. They are responsible for overseeing all household activities and generally have an active role in the public domain where decisions regarding village life are made. Women are largely absent from village decision-making forums, as meetings and discussions take place in the public domain (Enarson and Morrow, 1998). Women cannot participate in these public forums due to the necessity to observe purdah. However, women are able to express their opinions to a varying degree within the confines of their households. This is particularly true of post-menopausal women, who enjoy a great deal of freedom and often become "like men" (Abu-Lughod, 1986; Hewitt, 1991; Abu-Lughod, 1993). Whether their

opinions are listened to, considered, and reiterated at open village meetings depends on the household head.

The gendered division of labour, space, and influence described above, coupled with Islamic patriarchal beliefs, undermines the ability of women to access the necessary resources to decrease their vulnerability in the study communities (Enarson and Morrow, 1998). The effect that this gendered social organization has on women's access to resources is complex. There are often several mutually reinforcing factors that contribute to the inability of women to access resources such as land, education and health care.

The reasons why sons are more frequently educated than daughters are many (Ibraz and Fatima, 1993). One reason certainly worth discussing, however, is the benefit to the entire household as a result of educating boys rather than girls. Sons remain in their father's household for their entire lives, becoming the household head or contributing to household livelihood by performing agro-pastoral duties or by gaining off-farm employment and contributing a cash income. As parents age, they increasingly rely on their son(s) and their families to care for them and the entire household.

In contrast, daughters live in their father's home only until they are married (as young as fourteen in some villages), at which point they leave and join their husband's household (Herbers, 1997). Daughters often have little contact with their paternal household after marriage and spend the rest of their lives contributing to their husband's household. In this manner, daughters are temporary residents of their paternal household whereas sons remain for their entire lives. Consequently, a household benefits more, from a functional and material point-of-view, from educating a son rather than a daughter.

This is not to say that educating girls is perceived to have no value within the study communities (Summers, 1992). Certainly, in recent years, significant inroads have been made into girls' education in the study communities and throughout the Northern Areas. However, the motives behind a household's desire to educate daughters often remain tied to household well-being, rather than a recognition of the inherent value of education. Girls who receive an education can often marry into more prominent families within the community, and thus, through social ties, improve the social standing of her paternal household (Herbers, 1997).

The restrictions the observance of purdah places on the mobility of women, and on women's interactions with unrelated men, seriously affects their ability to obtain proper health care for themselves and their dependents (Halvorson, 2000; Hewitt, 2003). Women must rely on their male relatives to supply money to buy medicine, to escort them to dispensaries, and to take them to hospitals in the nearest town when they are ill. The poor state of health conditions within the villages, resulting from poor hygiene and unsanitary water conditions, coupled with the lack of health care facilities within the village, are some of the greatest impediments to women's access to health care (Halvorson, 2000; Azhar-Hewitt, 2003).

Both Nomal and Haldi have a village dispensary, as do most villages in the Northern Areas. However, local women are apprehensive to utilize these facilities for several reasons. Most dispensaries employ non-local men with minimal first aid training to distribute medicine (Azhar-Hewitt, 2003). Village women are reluctant to visit these men. Also problematic is the cost of medicines. Women must rely on male relatives for money to purchase medicine. Thus, men must think the expense is warranted. Even when

medicine is purchased, it is often out of date and, as a result, is little help to sick household members (Azhar-Hewitt, 2003).

Hospitals are only found in more major centres, such as Gilgit and Khapulu for Nomal and Haldi respectively. However, women are seldom taken there for treatment as they are rarely permitted to leave the village and hospitals are located a considerable distance away (Azhar-Hewitt, 2003). In the few instances that women are taken, which is usually only in life-threatening circumstances, male relatives accompany them. The majority of doctors staffed at hospitals in the Northern Areas are male. This presents a major obstacle to the proper treatment of female patients as purdah makes the treatment of women by male physicians strictly prohibited. As a result, women are only superficially examined on the outside of their clothing and their symptoms are related to the doctor by their male relative(s) (Azhar-Hewitt, 2003).

Health centres have been recently established in some villages in the Northern Areas. They are more commonly found in villages in Gilgit District than in Ghanche District. These facilities are particularly suited to the needs of local women and have considerably improved the health of women and their children (see Appendix C). Health centres have been particularly successful in achieving this goal for the same two reasons that usually prevent proper health care for women. These are the building of the centre in small villages, and the staffing of local women as Lady Health Visitors or LHVs (Herbers, 1997). Here, women can obtain treatment from female health workers at a minimal cost. They can also attend educational sessions addressing concerns specific to women's health and responsibilities, such as family planning, prenatal care, and household hygiene.

Women's vulnerability is also tied to how local women perceive themselves and their role in their society. Women are defined by other villagers and define themselves in terms of their relationships with men, particularly their fathers or husbands (Herbers, 1997). Many women consider their dependence on the decisions and resources of men as natural and expected, since they have usually not experienced anything different (Enarson and Morrow, 1998). From a young age, girls are told repeatedly what they are and are not capable of doing and what their role in society should be. Women internalize this dialogue, believing in the inherent limitations of what it means to be female in their society (F. Azhar-Hewitt, 2003, pers. comm.). They often say that they would be unable to perform the productive tasks for which men are responsible such as ploughing or planting seeds. This belief is widely held by women despite the fact that they perform other essential and skilled tasks for the subsistence economy.

Women have an important role as the keepers of honour in the society (Azhar-Hewitt, 1998). They bring honour to their male blood relatives by following the ways of Islam. Women of poor character diminish the social standing of their fathers and brothers, while women of favourable character improve their standing. However, once a woman's honour is lost, it can never be regained. Male household members will be looked upon favourably for disowning a dishonourable woman (Azhar-Hewitt, 1998).

This is not to say that women have no control over their role in society and never attempt to change the distribution of power within the household, but rather, that very few women see anything wrong with the status quo (Enarson and Morrow, 1998). Women often aspire to be mothers and wives rather than teachers or lady health workers, as this is what has been reinforced as the ultimate duty of proper Islamic women. Few female

villagers are given the opportunity to become well educated or skilled in a particular field (Herbers, 1997). However, those that are supported usually become quite successful and valuable to their household due to newly emerging opportunities as teachers in girls' schools and LHVs in health centres within the village confines. Female household members employed in these positions often increase the status of their household as employment as a teacher or LHV is prestigious within the village.

The vulnerability of women also arises from the invisibility of women's work and activities in the public sphere (Carpenter, 2001), their low status in the political economy of the household (Blaikie *et al.*, 1994), and their separation from development workers and researchers by status and language (Herbers, 1997). The productive tasks of women have been hidden from 'outsiders' as their work largely takes place within the confines of the home or in village fields not visible from the main road (Carpenter, 2001). Researchers and development workers are often uninterested in women's work and make no attempt to understand the division of labour within the community. As a result, the contribution to household livelihood made by women is often underestimated.

The low status of women within the household is also problematic. Development agencies and researchers often work with male heads of households as representatives of the entire household. Intra-household dynamics such as how resources are distributed and decisions are made within the household are often ignored (Bolin *et al.*, 1998). Researchers rarely speak to women directly and if they do, it is often in the presence of male relatives or other village members. In such a setting, women may not feel free to express their opinions openly, particularly when they conflict with societal norms regarding the role of women in the society (F. Azhar-Hewitt, 2003, pers. comm.). Even

when researchers are interested in intra-household dynamics, the inner workings of the household may be inaccessible to them. Local men and even women often feel that women have nothing useful to contribute to such discussions.

Another contributing factor is the separation of local women from researchers and development practitioners by status (through ethnic background, gender and/or education) and language (Herbers, 1997). Professionals working in the village are generally well-educated, non-local men who do not speak the local language. Village women often only speak the local language due to their limited formal education. As a result, discussions between these two parties are prohibited due to purdah and impossible due to the language barrier. Using female workers and local assistants can overcome these divisions to some degree; however, differences in status and education still exist (Wolf, 1996).

7.5.2 Women's differential vulnerability

While the previous section discussed some of the factors that contribute to women's increased vulnerability, this section details the factors affecting women's differential vulnerability. Women's vulnerability is not uniform within or between the study communities. Differences arise as a result of varying interpretations of purdah by the religious sects present in the study area, differences in life cycle stage and related responsibilities, and differences in socio-economic status and affluence (Azhar-Hewitt, 1998).

Three different Islamic sects are represented in the three study communities. These three sects observe purdah to varying degrees and with varying restrictions. Women of the Twelver Shi'ite sect in Nomal experience the greatest restrictions and are rarely seen in the village. Even within the household, women are rarely introduced to

visitors and do not serve chai or food. Nurbakhshi Shia women have fewer restrictions than Twelver Shia women in Nomal. When men are present, Nurbakhshi women are able to sit and listen to conversations and serve chai and food, however, they are seldom asked to participate in discussions with their male relatives. Isma`ili women have surprisingly few restrictions in comparison to the other two sects studied. For the most part, they appear to be highly regarded and respected by their husbands and male kinfolk. This may result, in part, from the fact that Isma`ili women often receive at least some formal education. Women of this sect, and particularly post-menopausal women, often openly participate in discussions with men about village issues. This is particularly true within kin settings. Their opinions were often asked for, and listened to, in household conversation. Ismai`ili women also observe a more lenient style of purdah than the other groups studied. They are able to walk around the village in groups without a male escort and are not always required to cover their hair with their chador.

A women's stage of life affects her mobility, her responsibilities within the household, her contribution to decision-making processes, and her access to money and health care (Herbers, 1997). Elderly mother-in-laws (who are post-menopausal) have a great amount of power within the household (F. Azhar-Hewitt, 2003, pers. comm.). They usually control the domestic sphere and distribute tasks to their daughters and daughters-in law, and sometimes even to younger male household members.

Mothers-in-law can make conditions unbearable for new wives. Newly married young women who have just moved into their husband's household are usually responsible for the majority of domestic tasks including cleaning, cooking and laundering. Local women related several instances when new wives jumped to their

deaths in fast-flowing rivers as a result of depression. They were often overwhelmed by their newfound status and workload in their husband's household.

Post-menopausal women have greater access to resources than women in other stages of their life cycle (Azhar-Hewitt, 1998). They often have access to small amounts of money so that they can purchase household provisions. Women having access to household stores of money usually wear a string, holding several keys, tied around their necks. Access to these resources, however small, can greatly reduce their vulnerability following a damaging event.

Differences in socio-economic status affect the mobility and responsibilities of women. More affluent households generally place more restrictions on the movement of female household members (Azhar-Hewitt, 1998). Household affluence allows men to enforce greater restrictions on women's mobility as the requirement of working in the fields is lessened. As a result, women are more secluded in the household compound. Less affluent households do not have this luxury. Female members of these households are needed outside the household to perform essential activities for the subsistence agro-pastoral economy.

7.6 The Role of Modernization Processes

Until recently, many villages in the Northern Areas remained relatively isolated and self-sufficient, with the exception of traditional barter relationships with other nearby mountain villages. However, beginning with Pakistani independence from British India in 1947, there has been increasing interest in incorporating the mountainous Northern Areas into lowland Pakistan, mainly for administrative and strategic military purposes

(Stellrecht, 1997). The main means of accomplishing this task was the building of the Karakoram Highway (KKH) in the 1970s and the building of secondary access roads to previously inaccessible valleys (Stellrecht, 1997). The joining of these small, remote villages to the KKH has facilitated a rapid rate of change in the region (Allan, 1989; Kreutzmann, 1991; Kreutzmann, 1993; Kreutzmann, 1995); the study communities have been no exception. Some changes include the introduction of the cash economy, interaction with local and distant markets, and social and economic change facilitated by local development agencies, tourism and foreign donors (Kreutzmann, 1995).

The so-called benefits of modernization are not evenly spread among village members or villages in the Northern Areas. As a result, the incorporation of modernizing influences has had significant consequences for the vulnerability of villages and community members. Modernization has simultaneously improved and worsened local conditions. Differences in spatial location, socio-economic status and gender often result in varying experiences of modernization processes (Azhar-Hewitt, 1999). In many cases, modernization has further alienated isolated communities, increased the gap between affluent and poor households and villages, and increased power differentials between men and women (Thomas-Slayter and Bhatt, 1994). This is not only to say that more prosperous and powerful community members, households and villages have improved their condition but, also, that conditions for the poor and powerless have worsened.

Major improvements have been made in some local systems such as health care and education as a result of modernization processes. Increased cash income is also common, particularly in Gilgit District (Kreutzmann, 1993). However, modernization necessitates changes in the very characteristics that make local systems successful. In the

majority of cases, households have begun to rely more heavily on external markets, off-farm employment income and cash cropping to supplement their activities within the village. These dependencies further erode local qualities that make the community so effective in coping with and responding to damaging events, namely their self-sufficiency and flexibility (Hewitt, 1997a). Moreover, the introduction of separate and distinct social organization structures by external agencies is compromising local management systems. It follows, then, that as social vulnerability is related to everyday conditions, the rate and conditions of modernization change vulnerability within and between villages.

Modernization processes have not been uniformly introduced or accepted throughout the Northern Areas. As a result, there are marked differences in levels of modernization within local communities. The next few sections will discuss some of the factors responsible for these varying modernization levels including: proximity to commercial markets and administrative centres, rate of change, the level of involvement of external agencies and the mode of development. Within villages, the effects of modernization have been particularly detrimental for women (cf. Azhar-Hewitt, 1998). The specific consequences of development for them will be discussed in the final section.

7.6.1 Proximity to Commercial Markets and Administrative Centres

My experience in the study communities leads me to believe that a relationship exists between the spatial location of a village relative to commercial and administrative centres and the diffusion of modernizing influences. It appears that modernization processes propagate outward from a central location, affecting those villages in close proximity to this centre first and those further away at a later time. Those villages in close proximity generally undergo an initially rapid rate of change followed by a somewhat

lessened rate over time, while those villages at a greater distance experience a much slower rate of diffusion.

Proximity to commercial markets affects the ability of villagers to sell their agricultural surpluses to earn cash income (Kreutzmann, 1991). Opportunities for selling crops at the market decrease with distance from the commercial centre and affect the potential development paths available to villages. For those villages situated close to the market, the selling of agricultural goods is a feasible option, as is daily or weekly out-migration for employment in this centre. For those villages further away, permanent relocation or alternative development paths are more practical.

In the Northern Areas, Gilgit is the dominant commercial and administrative centre, while Skardu plays a lesser role (Kreutzmann, 1993). The proximity of the study communities from these centres affects their ability to improve their livelihood conditions. Nomal is situated only 45 minutes by jeep from Gilgit. The close proximity of the village to this centre, the potential of the village to produce significant crop yields and the continued involvement of outside agencies have enabled villagers to earn income by selling agricultural surpluses. Haldi, on the other hand, does not produce significant agricultural surplus and is situated too far from regional markets to make cash cropping a viable development path.

7.6.2 Rate of Change

The rate of change within villages depends primarily on two factors. The first is the rate at which development initiatives reach the village and the second is the ability and desire of villages to accept and implement these changes. The first factor is closely tied to the proximity of the village to commercial and administrative centres as discussed

in the previous section. However, the spread of development initiatives is also facilitated by the location of regional offices, the accessibility of villages by road and the perceived willingness of villages to participate in the modernization process.

Isma`ilis are viewed as progressive and innovative and have been particularly eager to invite development agencies into their community, a process expedited and supported by their religious leader, the Aga Khan (who is situated far from the conditions of life in Northern Pakistan) (Daftary, 1990). Among the Twelver Shi`ite and Sunni sects, there has been an increased 'radicalization' in recent years (Zaman, 1998). Shi`ites, in particular, have a reputation as being too concerned with religious orthodoxy to want to improve their livelihoods. Development projects introduced by outside organizations, particularly ones associated with other Islamic sects and implemented by 'elites', are not always welcomed, nor are initiatives that change how life is lived in the community (F. Azhar Hewitt, 2003, pers.comm.). Nurbahkshis, and the people of Baltistan in general, have largely been left out of the development process due to their relative isolation from major commercial centres.

The second factor affecting the rate of change in the study communities relates to the desire and ability of villages to incorporate development initiatives. Socio-cultural differences produce varying desires to incorporate development initiatives. As a result, the rate at which modernization processes are being integrated into the lives of villagers varies greatly. In the village of Nomal, the Isma`ilis have been actively seeking the aid of development agencies to increase yields from the mixed farming system on which they rely which, in turn, will improve their economic situation. Haldi, on the other hand, has been slow to incorporate modernization influences. This is partly due to the relative

absence of development agencies working in the region, and partly due to a lack of desire among the villagers.

The ability of villages and households to take part in the modernization process also relates to their willingness and ability to experiment with novel agro-pastoral projects. These include the introduction of new mixed farming techniques, and technologies such as new seed varieties and crossbreeding with more productive livestock species (Pilardeaux, 1997). Villagers must be able to withstand crop or livestock losses, as positive outcomes cannot be guaranteed. This introduces a socio-economic component to the modernization process. Poor households are often unable to risk such losses as they have minimal landholdings and rely on their crop yields for subsistence. Thus, those households in the greatest need of improved livelihood resources are often unable to benefit from the development process.

7.6.3 The Role of External Bodies

External bodies, namely the Aga Khan Development Network (AKDN) and foreign donors, have been the primary facilitators of development in the study communities. One branch of the AKDN, the Aga Khan Rural Support Programme, is based in Gilgit and has been working throughout the Northern Areas since its inception in 1982 (AKRSP, 1995). Other branches of the organization including the Aga Khan Health Services (AKHS), Aga Khan Education Services (AKES) and Aga Khan Social Services (AKSS) have introduced programmes for health, education and social improvement in the region. These organizations are affiliated with the Isma`ili sect, however, their mandate is to improve the livelihood, health and social conditions of all the rural poor living in the region. This includes members of other Muslim sects (AKRSP, 1995).

The various organizations of the AKDN working in the region have been quite successful in achieving some of their goals and have considerably increased incomes, health services and educational opportunities in some villages (Halvorson, 2000). However, many villages and particularly poorer villages situated further from Gilgit have been left out of this process. In other villages where AKDN initiatives are present, the outcomes have been less successful. This is, in part, due to the reluctance of some members of other Islamic sects to affiliate themselves with an Isma`ili organization or with development workers who are essentially 'elites' because of their formal overseas education and monetary resources. Members of the Isma`ili sect are more open to development and change as it has been promoted by their religious leader (Daftary, 1998). 'Western' notions of development have not been promoted in the same way by leaders of the Shia and Nurbakhshi sects (Zaman, 1998).

Participation in AKRSP initiatives requires new forms of social organization to be established and the pooling of some of community members' monetary resources to secure loans (AKRSP, 1995). These two prerequisites are a hard sell for some members of local communities. Firstly, the Village and Women's Organizations (VOs and WOs) promoted by AKRSP do not take into account local systems of organization. New forms of social organization in some ways undermine existing power structures with both positive and negative outcomes. On the one hand, new forms of organization usurp dominant power structures in the village and allow some villagers who previously had little power to participate in village forums (D. Butz, 2003, pers. comm.). On the other hand, they disregard how local things are done in the community. This is problematic,

particularly when the aim is to achieve locally acceptable and appropriate development strategies.

The contributions of foreign donors have also been significant, particularly in villages far from administrative centres (such as Haldi). Funds provided by foreign donors have generally been used to build local infrastructure such as schools and health centres. However, development initiated in this manner tends to be haphazard and based on what foreigners perceive is needed in the village. The opinions of local people are rarely asked for and, in the rare instances that they are, it is usually only those in power that are able to voice them. More importantly, projects initiated by donors do not usually address the underlying causes of poverty, poor health and low education levels in villages. As a result, infrastructure is built but perhaps never used for its intended purpose. For instance, building a girls' school provides the infrastructure to hold classes but does not overcome the barriers within the community that prevent girls from attending school. These include labour shortages, limited income and socio-cultural taboos (Ibraz and Fatima, 1993). Until issues such as these are properly addressed, it is doubtful that any real improvement will be made in the communities.

7.6.4 Mode of Development

No matter what development course is taken, all, to some degree, rely on factors external to, and beyond the control of local communities (Hewitt, 1997a). The prevailing modes of development in the study communities include cash cropping and the sale of crops in commercial markets, development initiated by external agencies as discussed above and participation in the cash economy through outside employment. Instead of the self-sufficiency that characterized the region in the recent past, the new system is

susceptible to such things as market fluctuations, availability of seasonal labour and the whims of national and international travellers (Hewitt, 1997a).

The path of development chosen or perhaps forced, to some extent, upon the study communities is quite different. To date, the development course of the Isma`ili community in Nomal has relied heavily on agricultural surpluses sold in the nearby bazaars of Gilgit. These surpluses have largely resulted from the introduction of new seed varieties, cash cropping, and increasingly, the introduction of chemical fertilizers (Kreutzmann, 1993; Shah Makeen, 2003, pers. comm.). Another important aspect of their development course has been increased formal education of both young men and women. Higher education has allowed many male, and some female, villagers to secure professional employment and supplement their household's earnings with off-farm income.

Haldi's development path has been quite different than Nomal's as a result of the varying constraints and opportunities the village faces. Haldi is located much further from a commercial market and does not produce significant amounts of agricultural surplus to make cash cropping a viable development path. In addition, the village has had minimal involvement with external agencies. However, the village is situated in the Hushe valley which is regarded as a world-class location for mountain adventure including trekking and mountaineering activities. The village relies heavily on income generated through tourism-related activities (cf. MacDonald, 1995; MacDonald and Butz, 1998).

However, the tourism industry has been an inconsistent source of income for many villages as it depends on the whims of travelers and the state of world politics—spheres over which local villagers have no control (Butz, 2002). In recent years,

international tourism has been affected by tensions between India and Pakistan and conflicts among other Islamic countries in the Middle East. The most recent addition of what is erroneously, but widely, perceived and promoted to be Islamic 'acts of terror' on the United States and other Western countries (which culminated in the events of September 11th) has likely worsened this condition (Butz, 2002). Many Westerners have developed a biased view of Pakistan (and Islamic societies in general) and regard the area as unsafe. This perception has prevented many Westerners from travelling to any Muslim country. Haldi's location, close to the cease-fire line with India, and the restrictions placed on foreigners travelling to the Saltoro valley (foreigners must obtain a special permit in Islamabad), further aggravates this condition.

7.6.5 Modernization and the vulnerability of women

Modernization processes are altering everyday conditions in villages and changing the vulnerability of local women (Azhar-Hewitt, 1998). Various processes are increasing the workload and responsibilities of women, while failing to bring the promised benefits of modernization including formal education, income and increased decision-making power (Agarwal and Gibson, 2001).

The building of the KKH and secondary access roads has facilitated development in the region by connecting relatively isolated mountain villages with commercial markets, introducing the cash economy and providing the infrastructure for increased national and international tourism (Kreutzmann, 1993). These changes have provided men, particularly young, strong, skilled and educated men, with new ways of earning off-farm income. Male out-migration from the study communities has occurred on a seasonal and semi-permanent basis usually for high-paid, skilled employment in Nomal's case, and

guiding and portering jobs in Haldi's. The peak season of out-migration is summer months in both cases. Male out-migration leaves a shortage of labour within the villages during the growing season when the bulk of subsistence agro-pastoral activities are taking place (Herbers, 1997). Thus, those left in the village, specifically women, the elderly and children, are responsible for the majority of agro-pastoral activities traditionally done by men. This workload is in addition to their already time-consuming domestic and agro-pastoral responsibilities (See Figure 7.1).

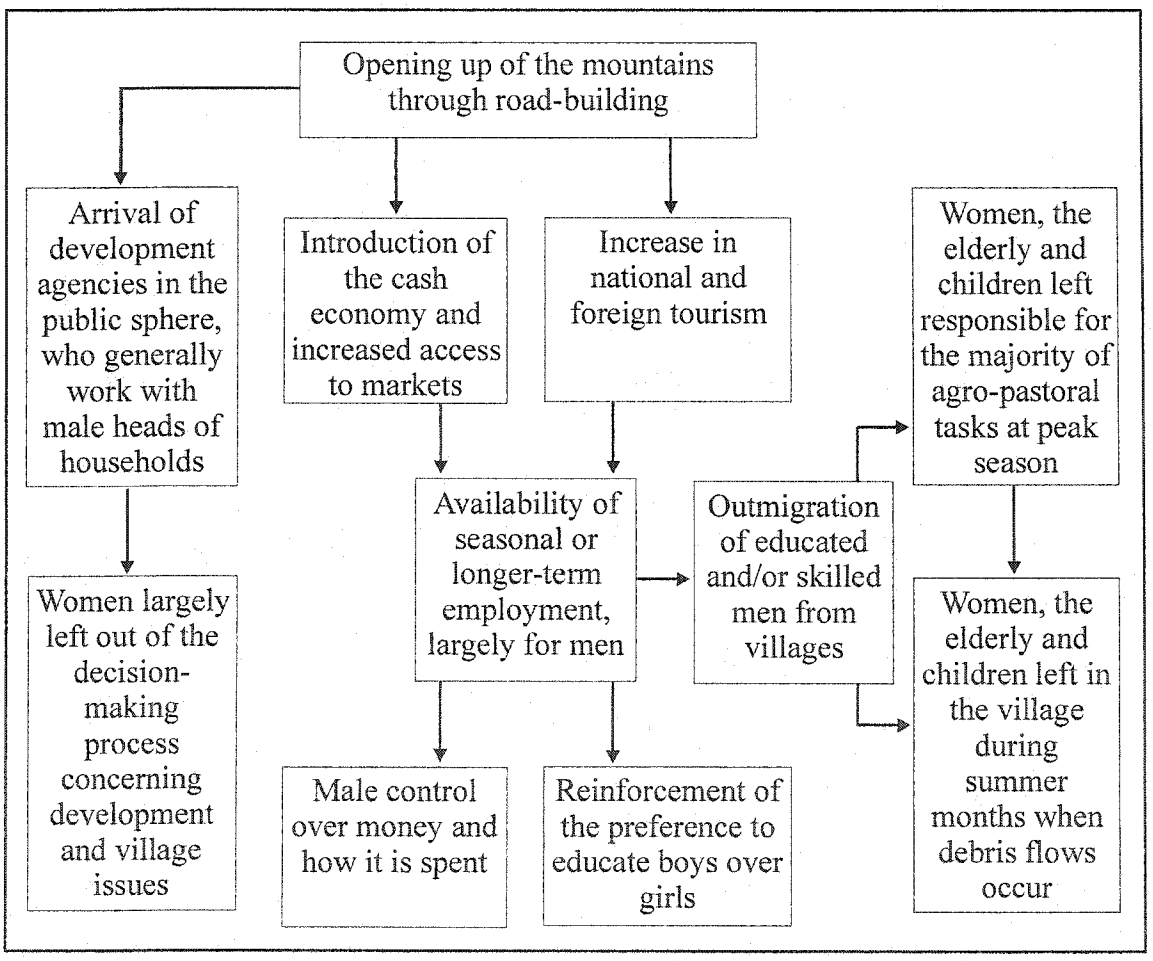


Figure 7.1: Schematic representation of how modernization processes are changing and generally increasing the vulnerability of women and their dependents within the study communities.

The timing of male out-migration is key to understanding why women are more vulnerable to debris flow and flooding events. The long absences of men during the summer months correspond with the peak occurrence of heavy rainstorms and high river discharges (Brunsden and Jones, 1984)—the conditions needed to initiate debris flow and flooding events respectively. Thus, it is women who are present and performing productive tasks in the village when damaging events occur.

Male out-migration also has significant consequences for the distribution of monetary resources within the community. Cash income is becoming another asset over which women have little or no control (Herbers, 1997). Men decide how money is best spent, usually without seeking input from other household members. As a result, money is often spent on luxury items to improve men's status, rather than on items that benefit the entire household or other household members (Azhar-Hewitt, 1998). In addition, women and girls' access to resources that require money, such as education and health care, becomes entirely dependent on men.

The preference to educate boys over girls is reinforced by opportunities in the cash economy for men (or a lack of opportunities for women), and the need to fill the labour shortage produced by male out-migration (Gupta, 1987; Ibraz and Fatima, 1993). The former is particularly relevant for formally educated men who have the potential to earn high wages. Educated boys can significantly contribute to their father's household later in life through off-farm income, while girls generally marry and leave at a young age. The absence of men places an ever-increasing burden on women for the subsistence economy. As a result, girls are often needed outside of school to perform agricultural tasks alongside their mothers.

The connection of remote villages to larger centres through roads has allowed development agencies to access local communities (Kreutzmann, 1991). To date, discussions regarding development have largely taken place in the public sphere, usually among male heads of households. The voices of women are largely absent from these discussions due their observance of purdah and the resultant restrictions placed on their social interactions and mobility (Herbers, 1997).

The near complete neglect of women's voices from discussions relating to development has occurred for several reasons. Firstly, there has been a tendency among development workers and researchers to treat male heads of households as representatives of the entire households with the implicit assumption that they represent the best interests of all household members. This is certainly not always true (Agarwal, 1988). Secondly, development workers and researchers are usually male 'outsiders' who speak the national language (Urdu) rather than the local language. This makes discussions with local women difficult as most only speak the local dialect. Lastly, women's productive tasks take place outside the public sphere, within the household or close to it, and women are kept out of sight from male 'outsiders' (Carpenter, 1991). Thus, the importance of women's work to the subsistence agro-pastoral economy has only recently begun to be appreciated.

7.7 Concluding Remarks

This chapter has illustrated the homogeneity of vulnerability within and between the study communities. Several factors were shown to contribute to differential vulnerability including: environmental opportunities and constraints, village

cohesiveness, socio-economic status, gender, and the rate and extent of incorporation of modernizing influences.

In relative terms, the Isma`ili community of Nomal has been shown to be less vulnerable than both the Shia community (of Nomal) and the Nurbakhshi community (of Haldi). This condition results from a number of factors that allow Isma`ili villagers to diversify their livelihood strategies including: the situation of the village at a low elevation providing a long growing season and agricultural surplus most years, strong village cohesiveness resulting from distinct Shia and Isma`ili communities, the affluence and relatively high socio-economic status of the village, and the close proximity of the village to a commercial market and regional hub of development activity. The higher vulnerability of the Shia community is largely a result of their continued reliance on the subsistence economy in a context that has modernized around them.

The conditions contributing to the vulnerability of the Nurbakhshi community differ greatly. The village is situated at a higher elevation, has a much shorter growing season and rarely produces agricultural surplus. It is located far from commercial and administrative centres and has little involvement with development agencies. Instead, the village relies on tourism and foreign donors. The former has proven to be a precarious and fluctuating industry dominated by a few powerful community members; the latter has provided infrastructure but has failed to address underlying issues, preventing an improvement in local conditions. The village remains poor, disjointed and relatively isolated and has few opportunities for members to diversify their livelihood strategy.

Women are particularly vulnerable in both of the study communities—a condition that arises from gender differences in socio-economic status, domestic responsibilities,

and power, as well as access to and control over resources (Enarson and Morrow, 1998). To date, modernization processes have generally increased women's vulnerability but failed to provide the supposed 'benefits' of modernization such as formal education, health care and cash income.

In many cases, vulnerability has not decreased as a result of modernization processes—at least not over the short period since their initiation. Overall, development has reduced the self-sufficiency, flexibility and cohesiveness of local systems. New forms of social organization threaten existing forms and change how things are done and how decisions are made in villages. In other words, development alters the very characteristics responsible for local success in coping with and responding to damaging events. As a result, villages are particularly vulnerable to damaging events during this period of transition.

CHAPTER VIII: CONCLUDING REMARKS

8.1 INTRODUCTION

This thesis has been concerned with describing differential vulnerability and social response to debris flow hazard in two distinct mountain communities of the Northern Areas, Pakistan. A variety of questions regarding debris flow hazard and vulnerability were raised in an earlier section of this thesis (See Section 1.3). These questions were addressed in detail through two case study analyses (Chapters 5 and 6) and a discussion section (Chapter 7). The purpose of this chapter is to summarize the main findings of the research and to reflect on the research process. A final section suggests recommendations for future research.

8.2 SUMMARY OF THE STUDY RESULTS

Debris flow and flooding events are common and recurrent hazards in the study communities. Debris flows generally result from heavy or prolonged rainstorms, while floods result from high discharges in summer months. The timing of these events corresponds with the peak season of agricultural production. As a result, lives, land, homes, livestock and crops have been lost.

The resiliency of local systems to damaging events result, in part, from the diversification and dispersal of productive activities horizontally along the valley floor, and through transhumance, vertically along altitudinal gradients far above the zone of permanent settlement. Cropland, which is owned privately, is usually scattered in small plots over available village lands. Villagers also make use of altitudinal gradients in

temperature and moisture. Ecological niches allow livestock to be grazed in high pastures and fodder to be grown outside the village. Through the dispersal of productive activities, villagers reduce their vulnerability to any one damaging event.

Social responses to damaging events have traditionally relied on community cooperation, as external assistance is rare. The actual adjustments implemented depend on the severity of the hazard and on the options perceived to be available to local residents. In the majority of cases, cropland inundated by sediment-laden waters is reclaimed due to land constraints in the villages. Relocation is not a common response but does occur following particularly large livelihood losses.

Social organization plays an important role in determining how losses are distributed within communities. These are patriarchal, Islamic societies. As a result, differences in vulnerability can be tied to the gender division of labour, space and influence within the communities; age, affluence and religious affiliation also play a part. Women's heightened vulnerability stems from a number of factors. Foremost among these are the religious beliefs of Islam and the observance of *purdah*, which affects women's mobility, decision-making potential and participation in development activities; local women's perception of themselves, their duties and roles in the community (including their internalization of societal roles); and outsiders' perceptions and representations of local women.

Socio-economic status also greatly affects the distribution of vulnerability within the community. This generally relates to a household or individual's access to resources and their social and kin ties both within and outside the village. Those individuals or households with considerable access to productive and economic resources, and with

strong kin and social ties, generally fare better than those without these same resources and social connections.

The study communities' exhibit comparable, but distinct, socio-cultural organizations based on historical processes, religious beliefs and cultural traditions. Of the three religious communities studied, the Twelver Shi`i community of Nomal were found to be the most vulnerable. This condition results mainly from their more orthodox religious beliefs and women's strict observance of purdah, their reluctance to participate in development initiatives, and their continued reliance on the agro-pastoral system in a context that has modernized around them.

The Isma`ili community is the least vulnerable community of the three studied. This condition results from the diversification of livelihood activities through both farm and off-farm initiatives, the relative wealth of resources they possess including cash, internal and external social ties, and their propensity to reinvest earned income to improve local conditions in the village. Improvements in the quality of life within the village have been more equitably shared among male and female community members than in the other study communities. Women have access to health care provided by female health workers, many girls have received a formal education and some young women have even gained off-farm skills and now work as Lady Health Visitors or school teachers.

For the most part, modernizing influences have not significantly improved conditions in local communities (perhaps with the exception of the Isma`ili community, although this remains to be seen). Instead, they have generally served to increase the vulnerability of already vulnerable groups (in particular women, the Shia community of

Nomal and those of low socio-economic status), while at the same time improving conditions for men, affluent households and communities with plentiful resources.

8.3 Reflections on the Research Process

I came into this thesis as a student of physical geography, looking at natural systems and 'problems' as ones requiring objective and impersonal solutions. There is no doubt that I attempted to employ these techniques in my early research and writing. However, in the course of fieldwork, and writing this thesis, it became apparent that a technical and objective approach was ill-suited to the concerns and questions being addressed—that is, to provide an understanding or explanation of damaging events at the village or intra-village scale in another culture and habitat. I quickly discovered that the real-life consequences and experiences of damaging events for individuals and communities were poorly-explained through an understanding of the debris flow hazard itself including its magnitude, frequency, duration etc. Instead, it became evident that the inequities in the society, brought about by a myriad of tangible and intangible qualities associated with history, culture and social organization, were a much better starting place for my inquiry.

However, as I learnt in the research process, characterizing, representing and writing about history, culture and social organization in a cross-cultural research context is by no means an easy task, especially when such aspects are constantly changing and evolving. Often times, I felt overwhelmed by the complexity of the villages I studied (villages I originally thought of as being of manageable size) and the range of experiences and concerns expressed by villagers. Trying to represent and characterize this

complexity in the writing of this thesis became another dilemma in and of its own. Necessarily, some generalizations were made, as no two individual's experiences are exactly alike, in order to allow comparison between groups and villages, as well as between time periods.

The field research and later writing of this thesis could have benefited from several changes in the research methodology. These were not originally employed as they represent, for the most part, lessons learned through the process of carrying out fieldwork.

Firstly, a working knowledge of local languages would have strengthened my confidence in my research results, allowed me to voice villagers' experiences and concerns in their own words rather than mine, and improved the overall effect of the thesis. I was apprehensive to represent the feelings, concerns and experiences of individuals through quotations or 'in their own words' as I was receiving incomplete information second hand through an interpreter. Moreover, conversations took place at a much quicker pace than could be translated and recorded accurately. As a result, discussions were often only recorded in point form during the interview session and later expanded upon following the interview. Some researchers have tape-recorded conversations with research participants to overcome this problem (Abu-Lughod, 1986), but such methods require that a significant level of trust be established between the researcher and the researched.

Secondly, a greater treatment of historical processes could have helped to portray the study communities as dynamic and continually changing, rather than as static or abruptly changing from one 'condition' to the next. In order to analyze some of the

changes occurring as a result of modernization processes, I perhaps produced a somewhat false dichotomy between two snapshots in time, namely, 'prior to modernization processes' and 'during and after the incorporation of modernization processes'. My intention was to identify points in time for comparison and not to suggest that villages are static.

8.4 Recommendations for Future Research

Several research needs were identified through the course of carrying out fieldwork. More detailed case study analyses, that specifically address village-scale vulnerability, are needed. Such studies would help to capture some of the actual variability that characterizes the region and further illustrate how differences in local environmental conditions and social organization affect vulnerability within communities.

More comparative assessments conducted by the same researcher(s), or more coordinated research efforts between teams, are also needed. Much of the present body of work employs different epistemological and/or methodological approaches. Studies often also differ in terms of research scope and focus. As a result, comparisons with or between these studies are difficult. Future research should aim to contribute to the existing body of work by employing comparable research approaches and techniques. Such an endeavour would allow comparisons to be made between villages.

More longitudinal studies are needed to monitor the changing conditions within communities. Newcomers to the region have carried out much of the present work; few continue their studies over longer time periods. The continued involvement of already

invested researchers and development workers and those with an appreciation for the complexity of the region, is needed. Studies of this nature are especially warranted, given the present context, to monitor the effect the rate and extent of modernizing influences is having on community vulnerability.

Studies that address some of the other concerns revealed but not adequately addressed by this study are also needed. This is particularly true of concerns voiced by local residents. Some of these include changes in diet and the introduction of new diseases to the community, the impacts of fertilizers on untreated water sources, and the lack of access to health care and formal education within rural communities.

Lastly, more studies that employ long-term in-community residence with local families would be beneficial. Access to communities, and particularly households, is granted slowly over time as trust is established and familiarity is increased. Living with a local family for an extended period of time is one way in which intra-household dynamics and the political economy of the household can be observed first hand. In-community residence and participatory methods overcome some of the problems associated with administering structured and semi-structured interviews. These methods are often an unfamiliar form of interaction and dialogue to local residents. Instead, participatory methods coupled with in-community residence are much more suitable, unobtrusive and productive means of gleaning information. In addition, these methods neither alienate local residents, nor emphasize the differences between the researcher and local residents.

APPENDICES

Appendix A: Sample Questions for Semi-Structured Interviews

Date

Number of respondent

Sex of respondent M F

Age of respondent in years Known Approximate

Position of respondent in nuclear family

Location of interview (name of sub-village)

Number of houses in this area or sub-village

Severity of hazard in this area or sub-village (estimate by interviewer)
High Med Low

Predominant language spoken in household

Religion

Number of persons in household M F

Number of children in household M F

Children attending school
Girls Y N
Boys Y N

Respondent from Haldi
Y N If no, where from?

Family members living in Haldi
Y N Living where?
Why?

Occupation (major source of income for the household)

Farming	Military
Education	Labourer
Shop owner	Businessman
Guide/porter/cook for expeditions	Other (specify)
Restaurant cook	

Location of occupation

Haldi	
Village in Baltistan	Specify:
Pakistan-downcountry	Specify:
Another country	Specify:

What are the principal advantages and disadvantages of living in this village?

Emphasis on: Advantages Disadvantages

Any hazards mentioned by respondent

What are the principal advantages and disadvantages of living in this area (sub-village)?

Emphasis on: Advantages Disadvantages

Any hazards mentioned by respondent

Do you have a lot of crops and trees? Are they usually healthy? If not, why?

What is it like living in Haldi in the winter (activities, weather,etc.)?

What changes have occurred/ are occurring in Haldi since you were young until now?

Are they good or bad changes?

How have these changes affected your daily life or the life of your family?

	Good	Bad	How?
Road			
Schools			
Shops			
Electricity			
Other (specify)			

What changes would you like to see in the future? How could these changes come about?

Do you have any problems living in Haldi?

Do other people have any problems living in Haldi?

Have you been affected by the 'flood'? Y N

What years have you been affected? How were you affected?

If lost crops:
what did you do for food?

did you replant your crops the next year? Y N

in the same place or a different place? Same Different

why?

If you have problems after a 'flood' occurs, who can you go to for help in recovering from the losses?

Family	Neighbour
Government	Special community member/group
No one	Other

How do they help?

Are there any signs or ways of knowing when a 'flood' is coming?

Are there any signs or ways of knowing when a 'flood' will come again?

What year was the worst year for the 'flood'?

When was the most recent 'flood'?

How often does the 'flood' come?

What did other people affected by the 'flood' do?

Is there anything that can be done to prevent damage from a 'flood'?

When a 'flood' comes, what do you do?

When a 'flood' comes, what do your neighbours do?

Interviewer comments:
Estimated income in relation to mean for group
High
Medium
Low

Interview situation
Alone
Group Specify:

Respondent's attitude

Helpful
Cooperative
Reliable
Neutral
Unreliable
Hostile

APPENDIX B: RESULTS OF INTERVIEWS REGARDING NATURAL HAZARDS, NOMAL

Table 1: Results of interviews conducted with research participants concerning natural hazards

	Natural hazard event and year of occurrence							
Research participant number, gender, and settlement	Flood 1960	Debris flow 1976	Debris flow 1988	Debris flow 1990	Debris flow 1992	Debris flow 1995	Debris flow 1997	Debris flow 1998
1 Male Madina-tul-karim		July *4-1/2 acres lost *11 houses affected *3 lives lost *livestock lost						April (at night) *5 or 6 houses affected
2 Male Madina-tul-karim	1961? *lost 2-1/3 acres	*lost his house *livestock killed *1 acre lost *has reclaimed approx. ½ his land						

3 Male Sadridinabad	*lost 1/8 acre	October (at night) *11 lives lost including one entire hshd (6 occupants)						
4/5 Both male Madina-tul-karim		*lost 1/8 acre					October *lost 1 acre, corn crops destroyed	Sept./ October *corn lost just before harvest
6 Female Madina-tul-karim		*lost their house and relocated *lost 2-1/2 acres *flood took everything			*house and land damaged			
7 Female Sadridinabad	*damage to their house and land							
8/9 Both male Madina-tul-karim		August 18 3:00 am *damage to his house and land						

10 Male Nomal Centre				*house damaged and 4-5 canals of his land affected *12 hshds and 50-60 canals of land affected				
11 Male Nomal Centre		*house damaged *lost entire harvest		*12 hshds and 50-60 canals of land affected				
12 Male Nomal Centre			Situated in permanent flood area beginning this year		Repeated floods *irrigation channels and lands affected, not houses	Repeated floods *irrigation channels and lands affected, not houses		Repeated floods *irrigation channels and lands affected, not houses
13 Male Nomal Centre			July? Situated in permanent flood area beginning this year *largest flood year		September Repeated floods *irrigation channels and lands affected, not houses	? Repeated floods *irrigation channels and lands affected, not houses		August Repeated floods *irrigation channels and lands affected, not houses

Table 2: List of interviews conducted, and topics discussed, with local specialists regarding village life.

Interviewee	Position or title	Discussion topics
Shah Makeen	Manager, Field Management Unit of AKRSP, Gilgit	AKRSP initiatives in Gilgit District and the Nomal area including agriculture, livestock, forestry, credit programs and social organization. With regards to natural hazards, spoke of protective spurs for areas vulnerable to erosion and flooding, rotational grazing and reforestation projects.
Amil Khan	Coordinator, M&E, Policy and Research, AKRSP	Introduction of commercial cherry growing analysis in Nomal. Present conduction of a cost-benefit analysis of the commercial cherry industry. The role of AKRSP in village development.
Dr. Rehmat Hussain	Dentist and Veterinarian, Gilgit	Masters thesis entitled "Identification and Documentation of Goat Breeds of the Northern Areas of Pakistan", Department of livestock management, Sindh Agriculture University, Tando Jam. Report commissioned by AKRSP entitled "A Monitoring Report on Damani and Kail Sheep Breeds in FMU Gilgit" (January 2000)
Syed Safeer Hussain	Member Union Council (elected position), Nomal	Duties as a member on the Union Council of Nomal. The Union Council decides how money provided by the government will be spent in the community.
?	Lady Health Visitor (LHV), Aga Khan Health Centre, Nomal	The role and objectives of the Aga Khan Health Centre in Nomal and surrounding villages. Statistics on causes of death and sickness by gender and age. Health survey conducted in Sadridinabad.
Akbar Hussain	Graduate Student	Thesis topic: Bird species in the Naltar Valley. Village names, no. of households and cultural background in area.
Ali Mohammed	Elder, Lower Jutal	Settlement of Hunza River floodplain and the hazards such settlement entails. Demography of the region.
Farman Shah	Resident of Sadridinabad and of Chotal Ghutomb (high summer pasture)	The use of high pastures for livestock grazing, wood harvesting and fodder production in the summer months. Organisation and calendar of activities in high pastures (Lower Echen-April only, water provided by snowmelt, Barra Echen and Chotal Gutum-May to October, water provided by irrigation channels).

Iqbal Karim	Managing Director, Palace Hotel, Bala Naltar	Tourism in the Naltar Valley.
Farzana Shaheen	Teacher English-medium school	Education in Nomal Flooding in Madina-tul-karim, Village Nomal
Mehr Bano	Teacher English-medium school	Education in Nomal

APPENDIX C: AGA KHAN HEALTH CENTRE STATISTICS

Deaths by age and cause, 1999 and 2000 (Source: Aga Khan Health Centre-Nomal)

Age and cause	Number of deaths 1999 (all quarters)	Number of deaths 2000 (first quarter only)
Less than 12 months	9	1
Pneumonia	*3*	*1*
Diarrhea	*2*	*0*
Other causes	*4*	*0*
12 to 59 months	1 (from other causes)	0
5 years and older	18	5
Maternal deaths	*2*	*0*
Other causes	*16*	*5*

Results of Community Health Survey, Sadridinabad, Nomal Village, 2000 (Source: Aga Khan Health Centre-Nomal)

A. Demographic profile

Total number of household members 602

Age group	Number of individuals	
	Male	Female
Less than one year	6	10
One to five years	38	29
Child-bearing age		163
Present pregnancies		13

B. Treatment sources

Treatment source	Number of individuals reporting use
Nowhere	6
Home remedies	--
Hospital/dispensary	54
Health centre	4
Private clinic	14

C. Antenatal care

Yes	49
No	22

D. Immunization Status

Not done	6
Mobile by AKRSP	52
Government hospital/mobile	20
Others	4

E. Knowledge about Immunizations

Yes	14
No	56

F. Source of Water

Tap	45
Well	30
River	0
Other	4

G. Purification of Drinking Water

Boiling	6
Nothing	64
Other	5

H. Use of Salt

Iodised	64
Rock	24
Other	1

I. Cause of Diarrhea

Flies	13
Food	9
Fingers	5
Fruit	15
Other	52

J. Family Planning

Yes	39
No	32

K. If not using family planning, why?

Husband does not like it	8
Want more sons	3

L. Deaths

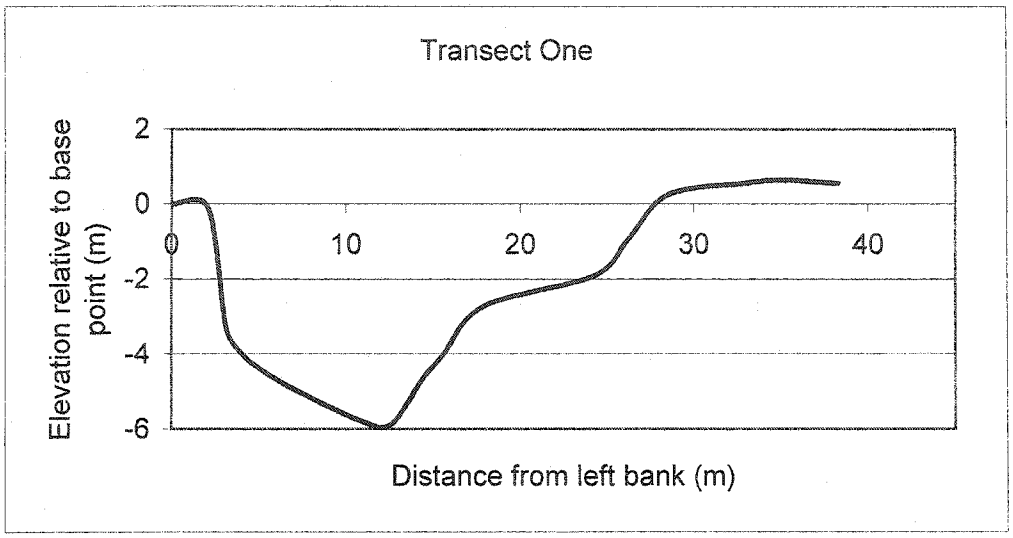
One to five years	1 I.U.D.
Over five years	1 T.B., 1 U.T.I

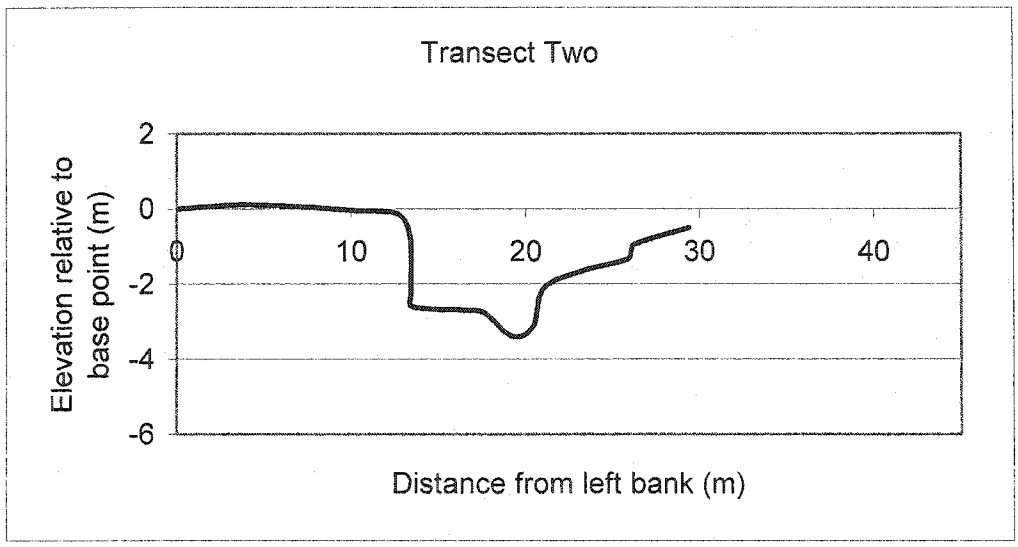
M. Services available at Health Centre

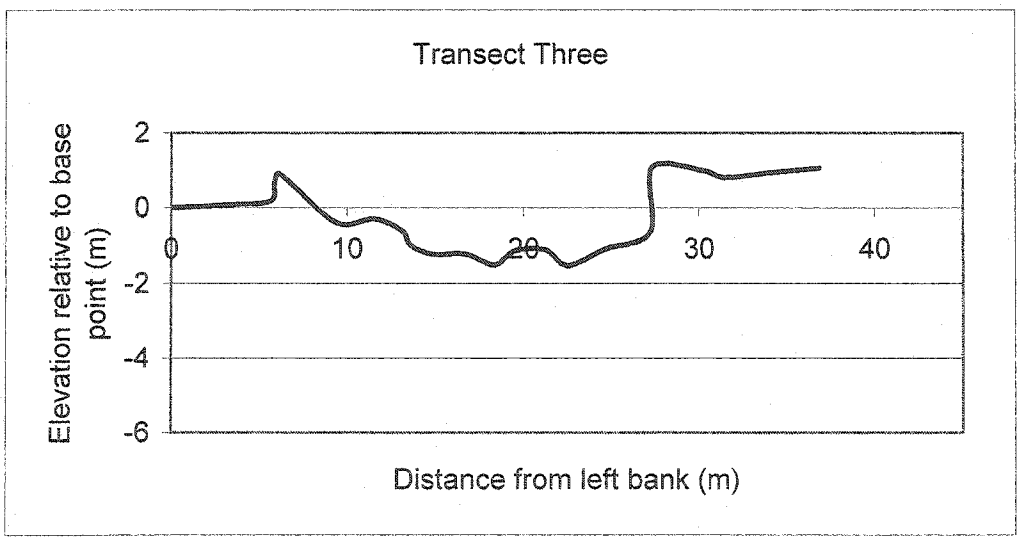
Service	**Cost of service (Rs)**
Registration	30
Check-up	20
H.B.	20
Blood Group	50
Urine AIG Sugar	20
Urine RIE	30
Delivery	300
Health Education	10
Post-natal visit	
Home visit	
Meeting	
Vaccine	
Follow-up	
Family planning	25

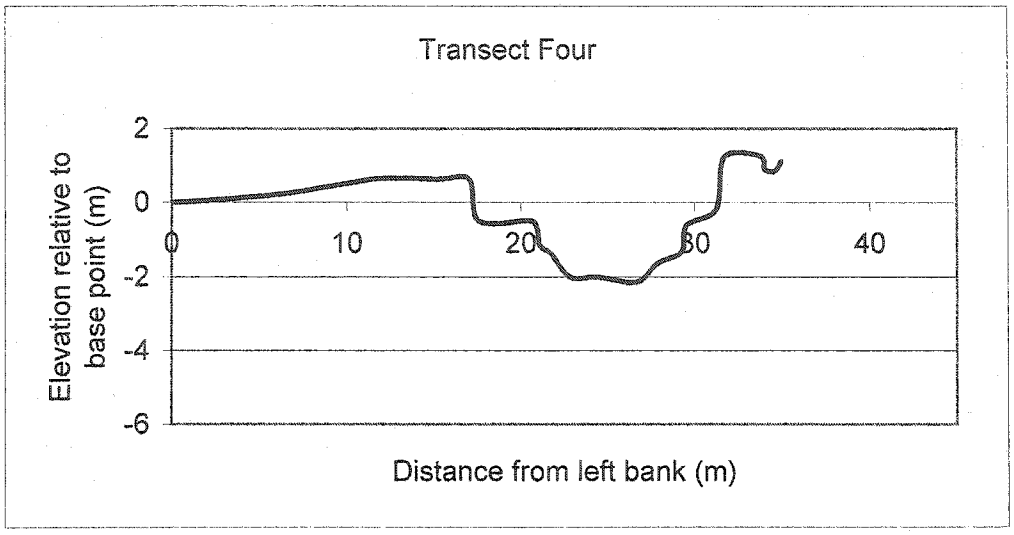
APPENDIX D: CROSS-SECTIONAL AND LONGITUDINAL PROFILES, HALDI

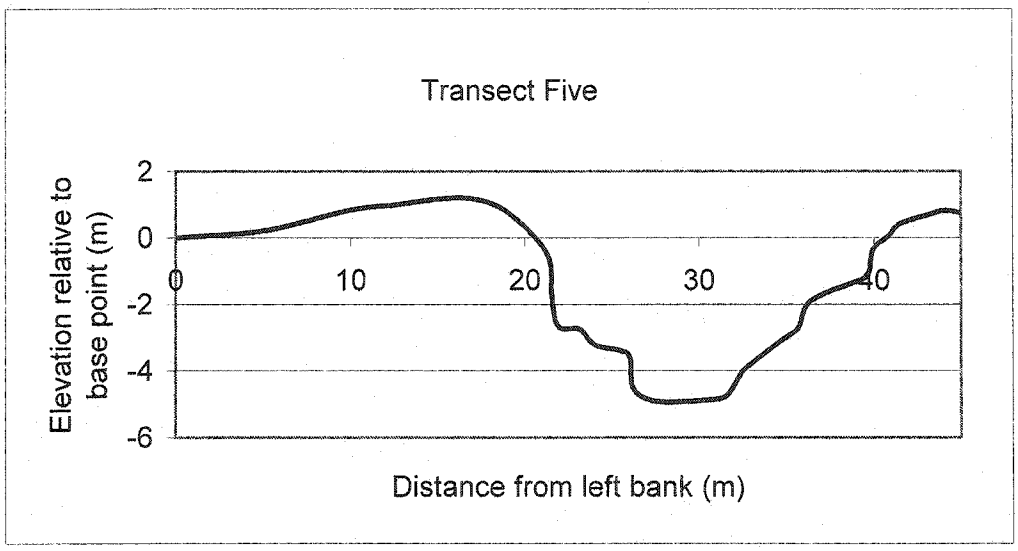
1. Debris Flow Cross-Sections: Transects One through Nine








Transect Four
Elevation relative to base point (m)
2
0
-2
-4
-6
0
10
20
30
40
Distance from left bank (m)


Transect Five
Elevation relative to base point (m)
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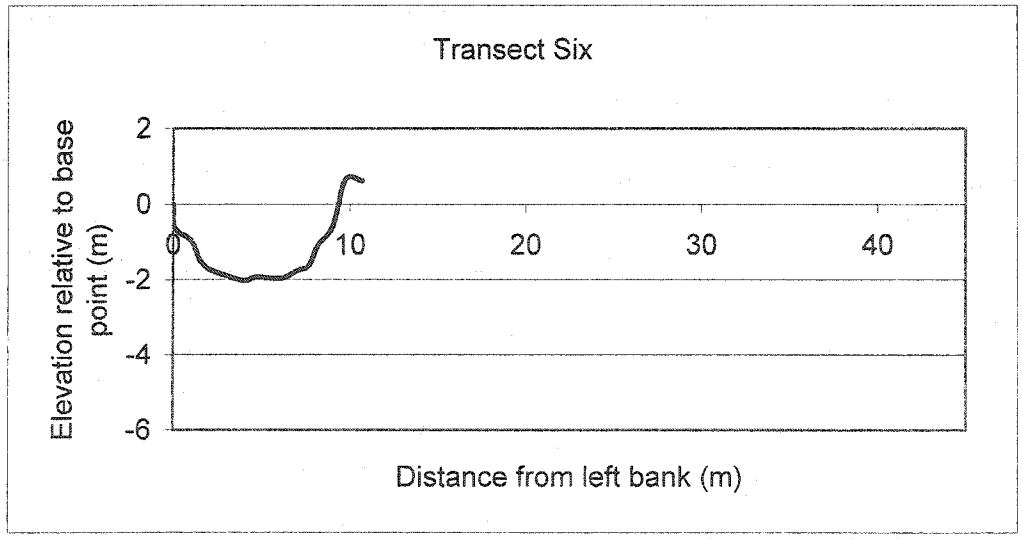
-2
-4
-6
0
10
20
30
40
Distance from left bank (m)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Elevation relative to base point (m)
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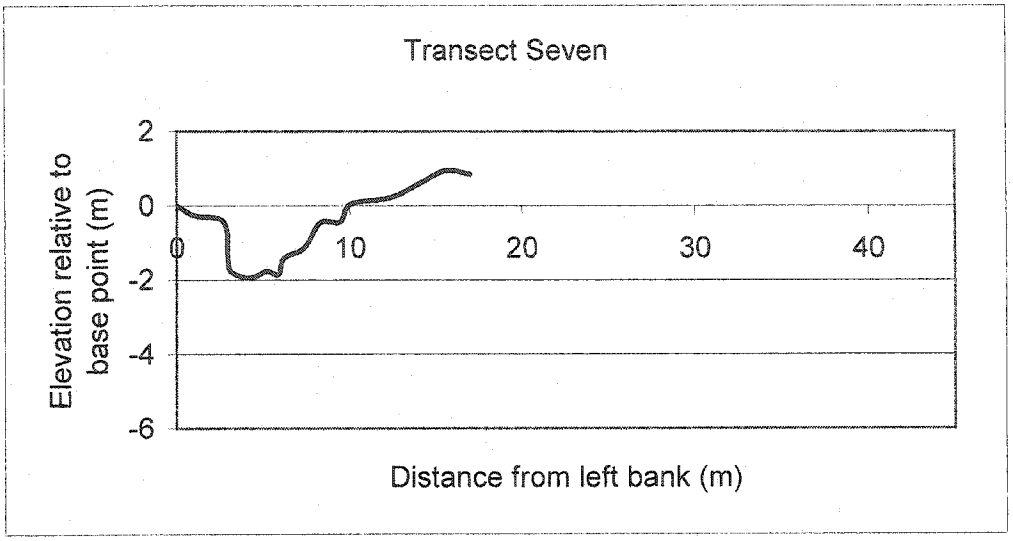
-4
-6
0
10
20
30
40
Distance from left bank (m)


Transect Seven
Elevation relative to base point (m)
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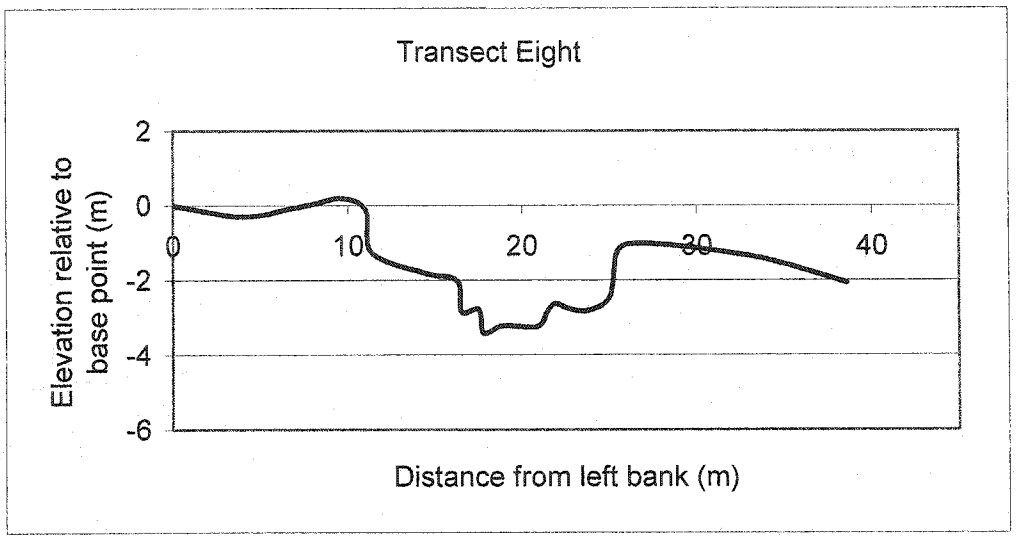
-2
-4
-6
0
10
20
30
40
Distance from left bank (m)


Transect Eight
Elevation relative to base point (m)
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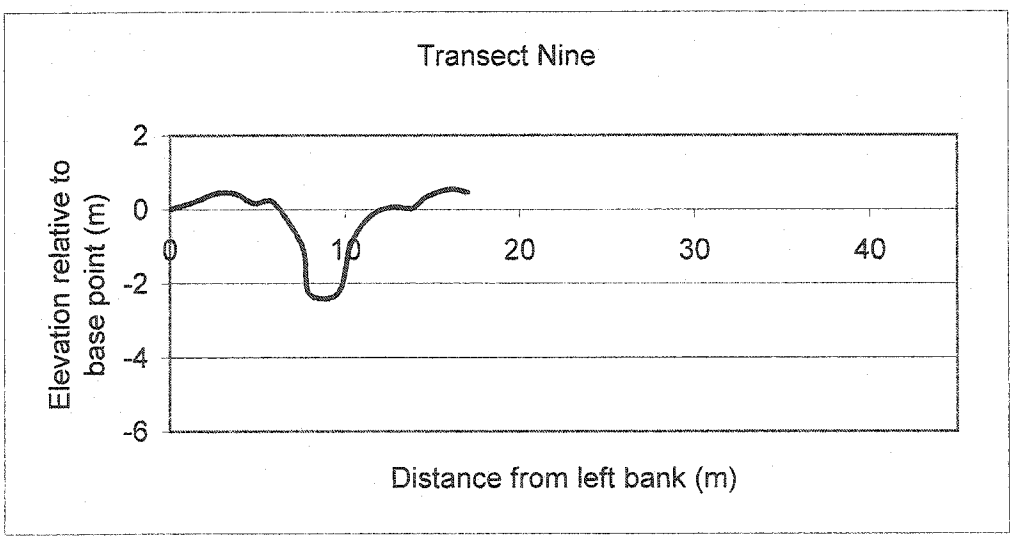
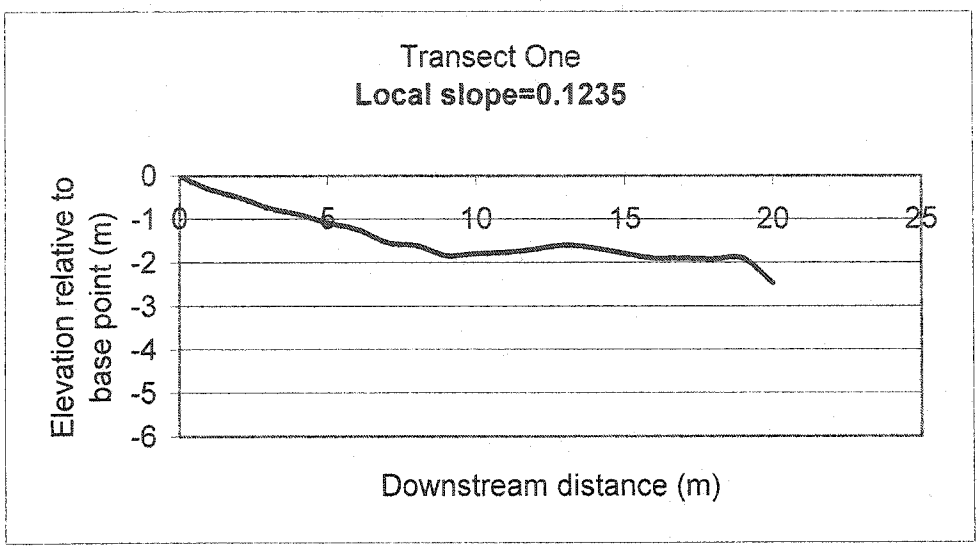
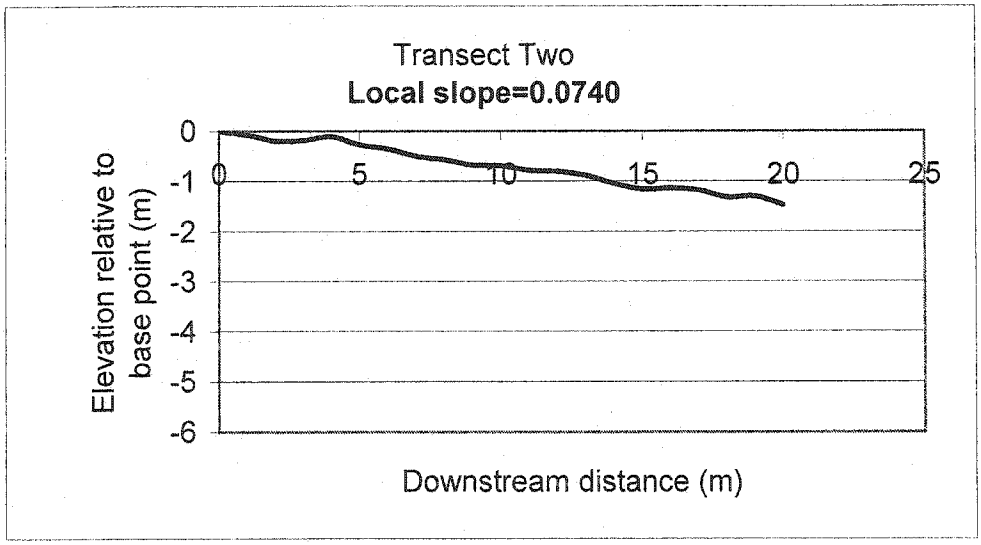
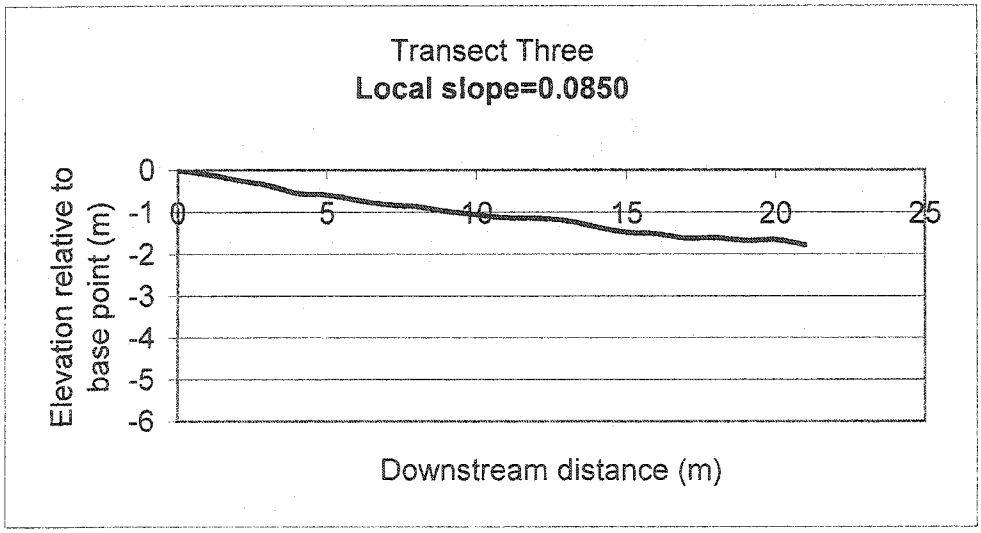
0
-2
-4
-6
0
10
20
30
40
Distance from left bank (m)

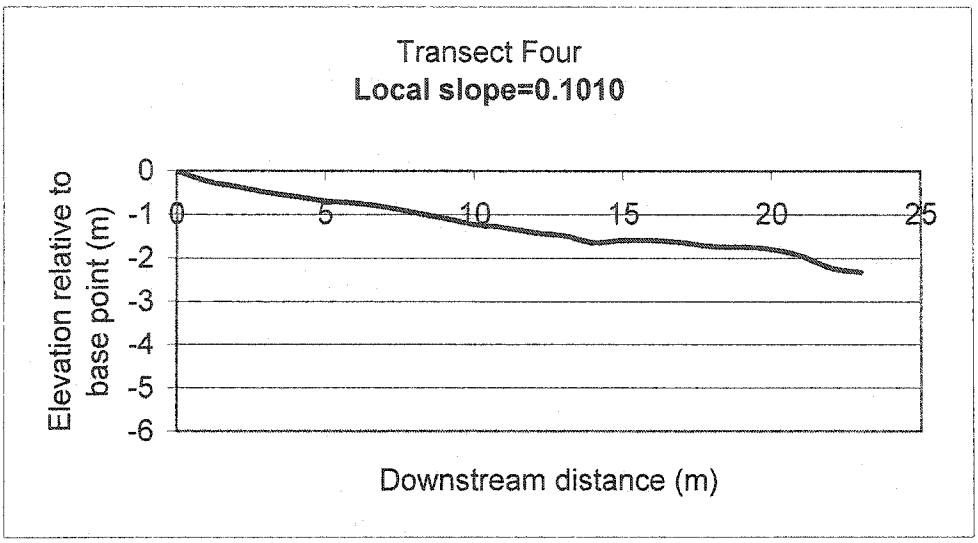

Transect Nine
Elevation relative to base point (m)
2
0
-2
-4
-6
0
10
20
30
40
Distance from left bank (m)

2. Longitudinal Profiles: Transects One through Nine








Transect Four
Local slope=0.1010
Elevation relative to base point (m)
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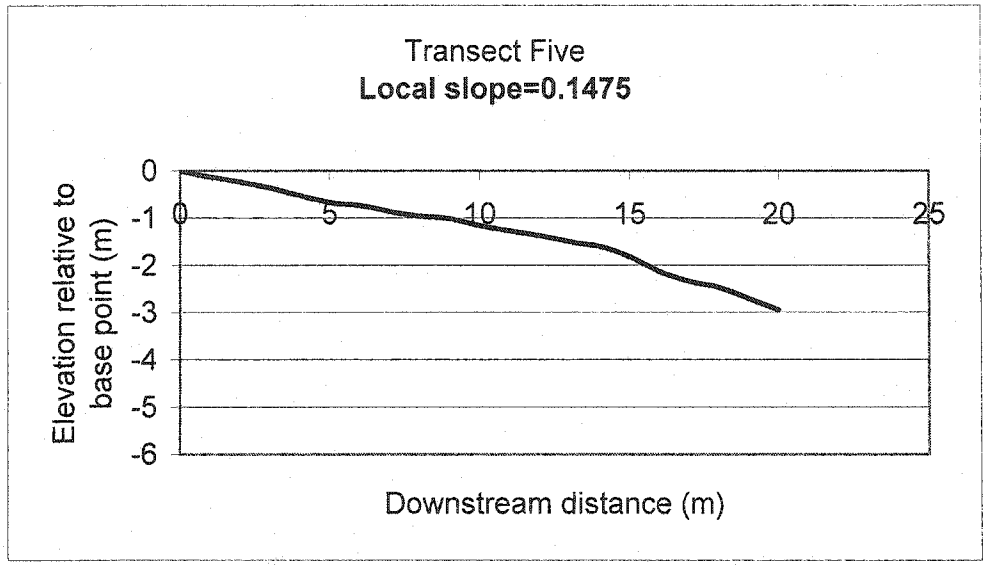
-1
-2
-3
-4
-5
-6
0
5
10
15
20
25
Downstream distance (m)


Transect Five
Local slope=0.1475
Elevation relative to base point (m)
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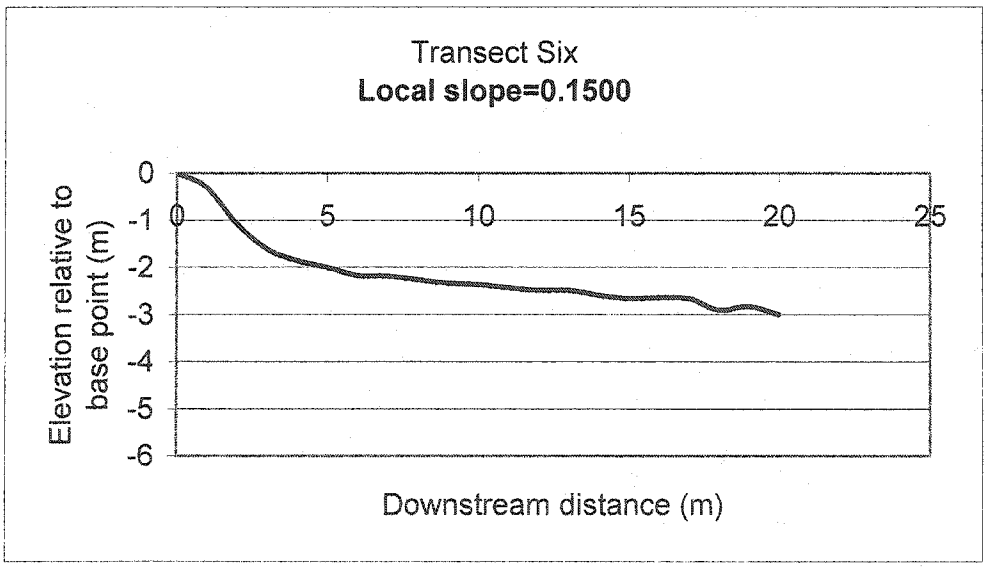
0
5
10
15
20
25
Downstream distance (m)


Transect Six
Local slope=0.1500
Elevation relative to base point (m)
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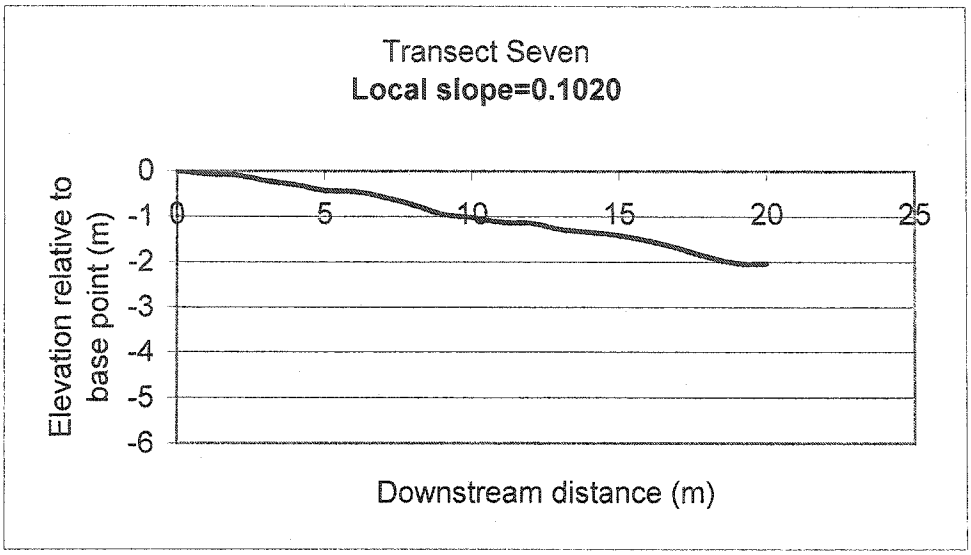
-1
-2
-3
-4
-5
-6
0
5
10
15
20
25
Downstream distance (m)


Transect Seven
Local slope=0.1020
Elevation relative to base point (m)
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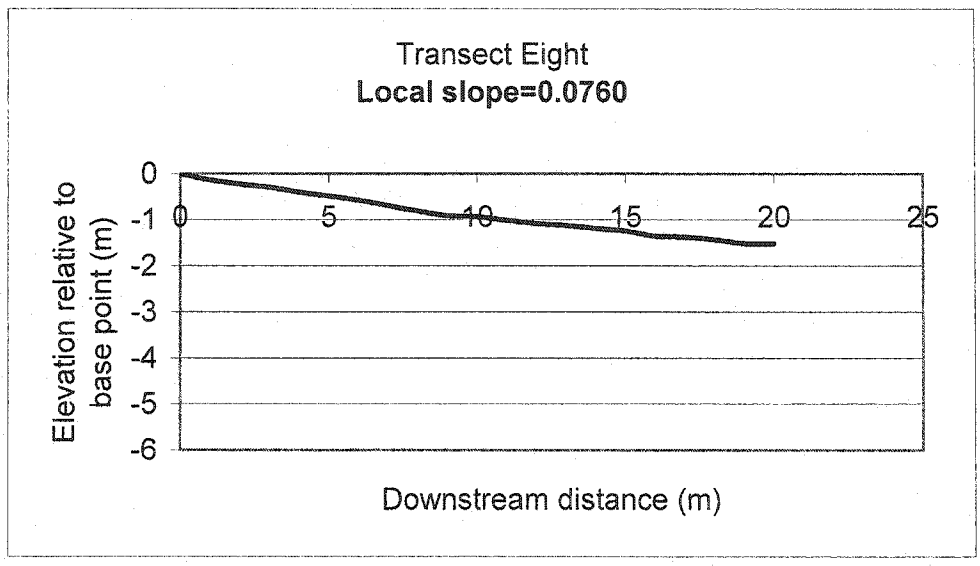
0
5
10
15
20
25
Downstream distance (m)


Transect Eight
Local slope=0.0760
Elevation relative to base point (m)
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-2
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-4
-5
-6
0
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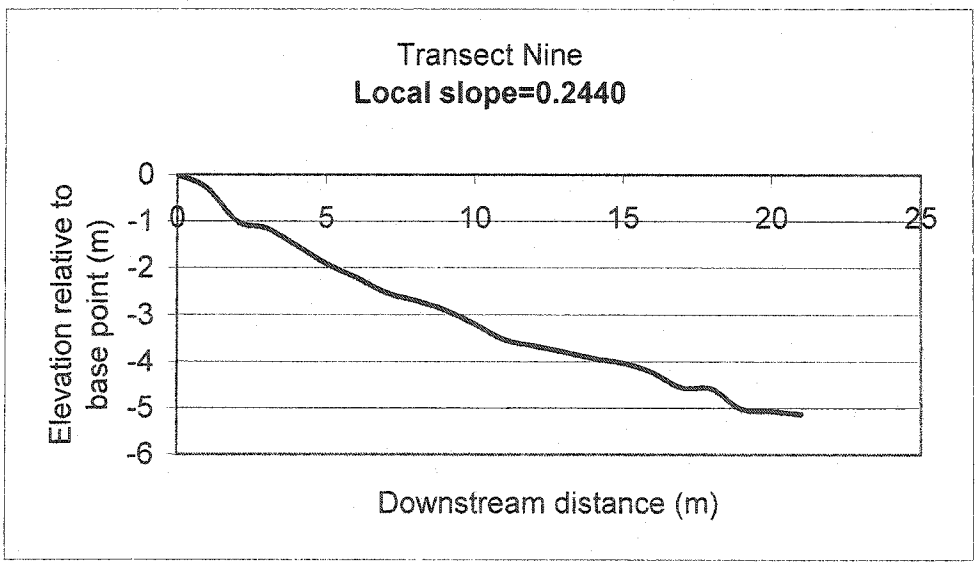
10
15
20
25
Downstream distance (m)


Transect Nine
Local slope=0.2440
Elevation relative to base point (m)
0
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-2
-3
-4
-5
-6
0
5
10
15
20
25
Downstream distance (m)

APPENDIX E: RESULTS OF INTERVIEWS REGARDING DEBRIS FLOW HAZARDS, HALDI

Research Participant Number	Settlement	# of houses	Gender	Others present at interview? (who)	Affected by debris flow? (H=house lost, C=crops lost)	
					1978	Recent
1	Bosayikor		F	No	No	No
2	Asurepekor		M	No	H, C	C
3	Tarhahnpekor	7	F	No	C	C
4	Bosayikor		F	Yes (husband)	C	C
5	Baransikor		F	Yes (women)	C	C
6	Baransikor	6	F	No	C	C
7	Skillkor	22	F	No	C	C
8	Nachchewykor	10	M	Yes (Men)	No	No
9	Jarayikor B	9	M	Yes (Men)	No	No
10	Skillkor		M	No	No	No
11	Kolyikor	12	M	No	C	No
12	Skillkor	20	F	Yes (female)	C	No
13	Sasayikor	12	F	No	C	C
14	Sasayikor	15	M	Yes (wife)	C	No
15	Nachchewykor	2	F	No	C	No
16	Chartung	1	M	Yes (wife)	H, C	No (moved)
17	Karmung	1	M	No	No	No
18	Asurepekor	6	F	No	H, C	C
19	Dablasir	9	F	Yes (sister)	No	No
20	Monkor	8	F	No	No	No
21	Jarayikor A	7	F	No	H, C	C
22	Holmalikpikor	3	F	No	No	C
23	Usoupekor	5	F	No	H, C	C
24	Rahmanpekor	6	F	Yes (female)	H, C	C
25	Waranpekor	10	M	Yes (family)	No	No
26	Rahimpekor	4	F	Yes (female)	No	C
27	Tarhahnpekor	8	F	Yes (female)	No	C
28	Asurepekor	6	F	No	H, C	C
29	Sasayikor	15	M	No	H, C	C
30	Jarayikor	10	M	Yes (male)	No	C
31	Chanpiyukpikor	2	F	Yes (female)	C	No
32	Bosayikor		M	No	C	C

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